7 Detailed Evaluation of Alternatives

This section provides an evaluation of each of the eight remedial alternatives described in Section 6. The detailed alternatives evaluation is conducted using MTCA and SMS criteria. These criteria govern the evaluation of remedial alternatives and the identification of preferred alternatives. This section is divided into three parts:

- Description of the MTCA and SMS evaluation criteria and remedy selection process (Section 7.1).
- Presentation of each alternative and how it addresses each of the MTCA and SMS criteria (Section 7.2)
- MTCA disproportionate cost analysis, used to identify preferred alternative(s) that are permanent to the maximum extent practicable (Section 7.3)

7.1 MTCA & SMS Evaluation Criteria

The MTCA and SMS regulations contain explicit criteria for the evaluation and selection of cleanup alternatives. This section provides an overview of these regulatory criteria. The consistency of each alternative with these criteria is then discussed in the subsequent sections.

7.1.1 MTCA Threshold Requirements

Cleanup actions selected under MTCA must comply with several basic requirements. Alternatives that do not comply with these criteria cannot be considered valid cleanup actions under MTCA. WAC 173-340-360(2)(a) lists four threshold requirements for cleanup actions. All cleanup actions must:

- Protect human health and the environment
- Comply with cleanup standards
- Comply with applicable laws
- Provide for compliance monitoring

All of the eight project alternatives contained in this Feasibility Study are designed to meet these threshold requirements.

7.1.2 Other MTCA Requirements

Under MTCA, when selecting from alternatives that meet the threshold requirements, the selected action must also address the following three criteria:

- **Provide a reasonable restoration time-frame** (WAC 173-340-360(2)(b)). MTCA places a preference on those alternatives that, while equivalent in other respects, can be implemented in a shorter period of time. MTCA includes a summary of factors that can be considered in evaluating whether a cleanup action provides for a reasonable restoration time-frame (WAC 173-340-360(4)). As described in Section 7.1.4, SMS regulations place a specific preference on remedies that can be completed within a 10-year restoration time-frame.

- **Use permanent solutions to the maximum extent practicable:** MTCA specifies that when selecting a cleanup action, preference shall be given to actions that are "permanent solutions to the maximum extent practicable." The regulations specify the manner in which this analysis of permanence is to be conducted. Specifically, the regulations require that the costs and benefits of each of the project alternatives be balanced using a "disproportionate cost analysis" (WAC 173-340-360(3)(e)). The criteria for conducting this analysis are described in Section 7.1.3 below.

- **Consider Public Concerns:** Ecology considers public comment raised during the RI/FS and EIS process in making its preliminary selection of a cleanup alternative for the Site. Ecology's preliminary decision is then articulated for public review in a draft Cleanup Action Plan.

7.1.3 MTCA Disproportionate Cost Analysis

The MTCA analysis of disproportionate costs is used to evaluate whether cleanup alternatives are permanent to the maximum extent practicable. This analysis compares the relative benefits and costs of cleanup alternatives. Seven criteria are used in the disproportionate cost analysis as specified in WAC 173-340-360(3)(f):

- Protectiveness
- Permanence
- Costs
- Long-Term Effectiveness
- Short-Term Risk Management
- Implementability
- Considerations of Public Concerns

The analysis compares the relative environmental benefits of each alternative against those provided by the most permanent alternative. These benefits can

be qualitative as well as quantitative. Costs are disproportionate to benefits if the incremental costs of the more permanent alternative exceed the incremental degree of benefits achieved by the other lower-cost alternative (WAC 173-340-360(e)(i)). Where the quantitative and qualitative benefits of two alternatives are equivalent, the department shall select the less costly alternative (WAC 173-340-360(e)(ii)(c)).

Additional description of each of the seven MTCA criteria used in the disproportionate cost analysis are described below consistent with WAC 173-340-360(f).

Protectiveness

Overall protectiveness is a parameter that considers many factors. First, it considers the extent to which human health and the environment are protected and the degree to which overall risks at a site are reduced. Both on-site and off-site risks resulting from implementing the alternative are considered. The parameter also expresses the degree to which the cleanup action may perform to a higher level than specific standards in MTCA. Finally, it measures the improvement of the overall environmental quality at the site.

Permanence

The permanence of remedies under MTCA is measured by the relative reduction in toxicity, mobility or volume of hazardous substances, including both the original contaminated media, and the residuals generated by the cleanup action.

Remedy Costs

The analysis of costs under MTCA includes all costs associated with implementing the alternative, including design, construction, long-term monitoring and institutional controls. Costs are intended to be comparable among different project alternatives to assist in the overall analysis of relative costs and benefits of different alternatives. Costs are evaluated against remedy benefits in order to assess cost-effectiveness and remedy practicability.

Long-Term Effectiveness

Long-term effectiveness is a parameter that expresses the degree of certainty that the alternative will be successful in maintaining compliance with cleanup standards over the long-term performance of the remedy. The MTCA regulations contain a specific preference ranking for different types of technologies that is considered as part of the comparative analysis. The preference ranking places the highest preference on technologies such as reuse/recycling, treatment, immobilization/solidification, and disposal in an engineered, lined, and monitored facility. Lower preference rankings are applied for technologies such as on-site isolation/containment with attendant engineering controls, and institutional controls and monitoring. The regulations recognize that in most cases the cleanup alternatives will combine

multiple technologies to accomplish remedial objectives. The preference ranking must be considered along with other site-specific factors in the ranking of long-term effectiveness. Table 6-1 illustrates the range of technologies used with each of the alternatives, in order of the long-term effectiveness rankings under MTCA.

Short-Term Risk Management

Short-term risk management is a parameter that measures the relative magnitude and complexity of actions required to maintain protection of human health and the environment during implementation of the cleanup action. Cleanup actions carry short-term risks such as potential mobilization of contaminants during construction, or safety risks typical to large construction projects. In-water dredging activities carry a relatively high risk of problems with water quality and potential sediment recontamination. Some short-term risks can be managed through the use of best practices during project design and construction, and other risks are inherent to project alternatives and can offset long-term benefits of an alternative.

Implementability

Implementability is an overall measurement expressing the relative difficulty and uncertainty of implementing the project. It includes technical factors such as the availability of mature technologies and experienced contractors to accomplish the cleanup work. It also includes administrative factors associated with permitting and completing the cleanup.

Consideration of Public Concerns

The public involvement process under MTCA is used to identify public concerns regarding alternatives, and the extent to which an alternative addresses those concerns is considered as part of the remedy selection process. This includes concerns raised by individuals, community groups, local governments, tribes, federal and state agencies, and other organizations that may have an interest in or knowledge of the site.

7.1.4 SMS Evaluation Criteria

Remedy evaluation criteria under SMS regulations are generally the same as under the MTCA. The SMS alternatives evaluation criteria are specified in WAC 173-204-560(4)(f)-(k). Most of these SMS evaluation criteria overlap with those of MTCA. The SMS evaluation criteria include the following:

- Overall protection of human health and the environment
- Attainment of cleanup standards
- Compliance with applicable state, federal and local laws
- Short-term effectiveness

- Long-term effectiveness
- Ability to be implemented
- Cost
- The degree to which community concerns are addressed
- The degree to which recycling, reuse and waste minimization are employed
- Analysis of environmental impacts consistent with SEPA requirements

Requirements under SMS for cleanup decisions are specified in WAC 173-204-580(2)-(4). This portion of the regulation specifies factors that are to be considered by Ecology in making its cleanup decision. Most of these requirements also overlap with those of MTCA. SMS cleanup decision requirements including the following:

- Achieve protection of human health and the environment
- Comply with applicable state, federal and local laws
- Comply with site cleanup standards
- Achieve compliance with sediment source control requirements
- Provide for landowner review of the cleanup study and consider public concerns raised during review of the draft cleanup report
- Provide adequate monitoring to ensure the effectiveness of the cleanup action
- Provide a reasonable restoration time-frame
- Consider the net environmental effects of the alternatives
- Consider the relative cost-effectiveness of the alternatives in achieving the approved site cleanup standards
- Consider the technical effectiveness and reliability of the alternatives

Like MTCA, the SMS regulations include a requirement for a reasonable restoration time-frame. However, SMS includes an explicit preference for restoration time-frames that are less than 10 years (WAC 173-204-580(3)). Longer restoration time-frames may be authorized, but only where it is not practicable to accomplish the remedy within a ten-year period.

Of the SMS evaluation criteria listed above, all but two are accomplished as part of the MTCA evaluation of alternatives. The two exceptions are 1) the completion of a SEPA analysis of environmental impacts, and 2) the analysis of net environmental effects of the alternatives. These two criteria are addressed as part of the companion Draft Supplemental EIS document. That document assesses environmental impacts of the remedial alternatives. Net environmental effects as defined under SMS are also captured by this analysis. Because the EIS document addresses specific SMS regulatory requirements it is considered an integral part of the analysis of alternatives. However, the information contained in that document is not repeated in this section, to avoid unnecessary redundancy. Other SMS criteria are addressed within the scope of the MTCA evaluation criteria.

7.2 Detailed Evaluation of Alternatives

Table 7-1 summarizes the detailed evaluation of each of the eight remedial alternatives against the MTCA and SMS criteria listed in Section 7.1. For each of the eight remedial alternatives, these findings are discussed below. Section 7.3 then conducts a MTCA disproportionate cost analysis and identifies the preferred remedial alternatives under MTCA.

7.2.1 Alternative 1

Alternative 1 uses containment, monitored natural recovery and institutional controls to comply with SMS cleanup levels and MTCA cleanup requirements It makes the least use of active remedial technologies of all of the evaluated alternatives. Alternative 1 is illustrated in Figure 6-1.

MTCA Threshold Requirements

Alternative 1 complies with MTCA threshold criteria, as do the other alternatives evaluated in the Feasibility Study.

- **Protection of Human Health and the Environment**: Alternative 1 protects human health and the environment by complying with applicable cleanup standards.

- **Compliance with Cleanup Standards:** Alternative 1 will comply with the cleanup standards described in Section 3.1. For the portion of the inner Whatcom Waterway that does not currently meet cleanup standards and that will be allowed to naturally recover, the cleanup standards will be met at the end of the recovery period. Recovery modeling would need to be performed to verify that the recovery period will not exceed 10 years.

- **Compliance with Applicable State & Federal Laws:** Assuming compliance with appropriate project permitting requirements this alternative will comply with applicable state and federal laws. Institutional controls will be addressed as part of the final Cleanup

Action Plan and Consent Decree. Land use issues associated with the ASB and waterfront areas would need to be considered as part of the ongoing land use planning process.

- **Provisions for Compliance Monitoring:** Alternative 1 provides for compliance monitoring in cap areas and in areas addressed through monitored natural recovery.

Restoration Time-Frame

The restoration time-frame for Alternative 1 is relatively long among the evaluated alternatives, and may exceed the SMS preference for a restoration time-frame less than 10 years. Between 1 and 2 years will be required for final alternative design and permitting. The construction period for the active phase of remediation is relatively short, requiring a single construction season. However, additional time (between 5 and 10 years) will be required for natural recovery of sediments within the Inner Whatcom Waterway area. The total restoration time-frame is estimated at between 6 and 12 years.

MTCA Evaluation Criteria

The MTCA disproportionate cost analysis includes comparative analysis of seven factors. Factors relevant to the disproportionate costs analysis are discussed below, and are summarized in Table 7-1. The disproportionate cost analysis, comparing the costs and benefits of all project alternatives, is performed in Section 7.3.

- **Overall Protectiveness:** The overall protectiveness of Alternative 1 relies solely on the use of containment, monitored natural recovery processes and institutional controls. Incremental protections present in the other alternatives are not used. Natural recovery is used both to comply with cleanup levels (i.e., to achieve compliance with cleanup standards in areas not currently meeting those standards) as well as to maintain protection in previously-recovered areas.

- **Permanence:** Alternative 1 does not reduce the toxicity or volume of contaminated sediments. The alternative uses only containment, natural recovery and institutional control technologies. All impacted sediments and ASB sludges are managed in place, and no effort is made to integrate the cleanup with area navigation and land use planning, resulting in significant potential for future anthropogenic re-exposure of contaminated sediments.

- **Costs & Cost-Effectiveness:** Alternative 1 is the least costly of the evaluated Alternatives. Cleanup costs are $8 million, compared to costs of $21 to $146 million for the other evaluated alternatives.

Remedy cost-effectiveness is achieved by minimizing the use of higher-cost, high-preference technologies (Appendices A and B).

- **Long-Term Effectiveness:** Alternative 1 uses institutional controls, monitored natural recovery and containment to achieve cleanup levels. Long-term effectiveness of this alternative is not as high as other alternatives that use higher-preference cleanup technologies such as removal, treatment, disposal and reuse/recycling. The effectiveness of monitored natural recovery as the sole remedial strategy for Whatcom Waterway areas may conflict with navigation uses. For example, concerns about sediment re-exposure from propeller wash may prohibit navigation and dock or float construction in some areas of the waterway. Other alternatives evaluated directly address navigation issues in the waterway with active remedial measures that accommodate anticipated navigation uses and shoreline development actions. The effective depth of the Waterway will vary with location. The long-term effectiveness of Alternative 1 will require verification modeling as part of remedial design, and will require appropriate institutional controls to be established as part of the Cleanup Action Plan and project implementation activities.

- **Short-Term Risk Management:** Because Alternative 1 has the least construction activity, it has the lowest level of short-term risks. The construction activities are limited to capping of the ASB sludges, enhancements to the Log Pond cap, and capping of two areas (Unit 5-B and Unit 6-B&C) of impacted sediments. Short-term risks under this alternative would be managed using appropriate construction techniques for cap application, water quality monitoring, and construction safety provisions. These management practices would be defined as part of remedial design and permitting. Work timing would be established in appropriate "fish windows" to avoid impacts to juvenile salmonids.

- **Implementability:** From a technical standpoint, Alternative 1 is readily implementable. The alternative uses capping technologies that are readily available, with experienced contractors available locally and nationally. However, the regulatory implementability of the alternative would depend on development of appropriate institutional controls in the Whatcom Waterway to address residual sediments managed by natural recovery. Such controls could adversely impact navigation uses in some areas. These impacts are discussed as part of the Draft Supplemental EIS.

- **Consideration of Public Concerns:** Public review of this RI/FS and of the companion EIS document will be used to solicit public concerns relative to this Alternative. Based on previous public

concerns noted during earlier RI/FS, EIS and land use planning activities, potential public concerns relevant to this alternative include 1) the conflicts between the Alternative and planned land uses at the ASB, the Inner Whatcom Waterway and at the Bellingham Shipping Terminal, 2) the reliance of Alternative 1 solely on low-cost, low-preference technologies to achieve compliance with cleanup levels, 3) the longer restoration time-frame and lower certainty associated with using monitored natural recovery to comply with cleanup levels in navigation areas of the Whatcom Waterway.

7.2.2 Alternative 2

Alternative 2 uses monitored natural recovery, institutional controls and containment technologies to comply with SMS cleanup levels and MTCA cleanup requirements. However, unlike Alternative 1, dredging of sediments from within the Whatcom Waterway is conducted. That dredging is conducted consistent with the 1960s industrial channel dimensions. Dredged sediments are managed in a new Confined Aquatic Disposal (CAD) facility that would be developed offshore of the Cornwall Avenue Landfill. The Cornwall CAD site location was selected during the 2000 EIS after evaluation of potential alternative locations. The remedial alternative design concept for Alternative 2 is shown in Figure 6-2.

MTCA Threshold Requirements

Alternative 2 complies with MTCA threshold criteria, as do the other alternatives evaluated in the Feasibility Study.

- **Protection of Human Health and the Environment**: Alternative 2 protects human health and the environment by complying with applicable cleanup standards.

- **Compliance with Cleanup Standards:** Alternative 2 complies with the cleanup standards described in Section 3.1. Cleanup standards are addressed using active containment measures including in-place capping, as well as dredging with containment in a newly-constructed CAD facility. Alternative 2 does not use monitored natural recovery for areas that remain above applicable cleanup standards. Monitored natural recovery is applied only in areas that already comply with cleanup standards.

- **Compliance with Applicable State & Federal Laws:** Assuming compliance with appropriate project design and permitting requirements this alternative will comply with applicable state and federal laws. Institutional controls will be addressed as part of the final Cleanup Action Plan and Consent Decree, and as part of project implementation. Land use issues associated with the ASB

and waterfront areas would need to be considered as part of the ongoing land use planning process. The alternative involves the creation of a new sediment disposal site within shoreline areas. Project design and permitting would need to address water quality protection and other short-term and long-term risks associated with the CAD site development.

- **Provisions for Compliance Monitoring:** Alternative 2 provides for compliance monitoring in cap areas and in areas addressed through monitored natural recovery. Additional monitoring costs are allocated for the CAD site.

Restoration Time-Frame

The restoration time-frame for Alternative 2 will be determined by the start-date of construction and the duration of work activities. As described above, the construction in shoreline areas of the Inner Whatcom Waterway will need to be integrated with shoreline redevelopment actions in order to coordinate sediment dredging with shoreline infrastructure upgrades. Such activities would require substantial funding investments by local property owners and/or local governments, and would also involve substantial design and permitting requirements. As a result, the start-date for construction would likely be at least 2-5 years from the time of Consent Decree approval. Construction activities would likely be completed within 4 years. Therefore, the restoration time-frame for this alternative is estimated at between 6 and 9 years.

MTCA Evaluation Criteria

The MTCA disproportionate cost analysis includes comparative analysis of seven criteria. Issues relevant to the disproportionate costs analysis are discussed below, and are listed in Table 7-1.

- **Overall Protectiveness:** The overall protectiveness of Alternative 2 is achieved through the use of active measures, and is improved over that achieved by Alternative 1. The dredging and capping in the Whatcom Waterway improves the protectiveness in this area, by reducing the potential that navigation uses in this area will resuspend residual subsurface sediments. Subsurface sediments will remain capped in some berth and waterway areas, but these remaining areas will be contained with a cap, designed to resist prop wash and to be stable under anticipated wind and wave conditions.

- **Permanence:** Alternative 2 does not reduce the toxicity or volume of sediments or ASB sludges remaining on the waterfront. The alternative does consolidate the sediments dredged from the Whatcom Waterway in a CAD facility, and Waterway navigation

areas are deepened and capped, reducing the potential for future anthropogenic resuspension of contaminated sediment. This results in a greater degree of permanence than that in Alternative 1. But conflicts with planned aquatic uses of the ASB are not addressed under this alternative, resulting in a lower degree of permanence for this area of the site than in other evaluated alternatives (i.e., Alternatives 5 through 8).

- **Remedy Costs & Cost-Effectiveness:** The probable cost of Alternative 2 ($34 million) is substantially more costly than Alternative 1 (Appendices A and B). However, it is similar in cost to Alternatives 3 through 6. The increased costs of alternative 2 are associated with the active capping, sediment dredging, CAD site development, and additional long-term monitoring of the CAD facility.

- **Long-Term Effectiveness:** Alternative 2 uses a combination of institutional controls, monitored natural recovery and containment to achieve cleanup levels. However, all sediment areas that do not currently meet cleanup levels, and the navigation areas of the Whatcom Waterway are remediated using active measures. Long-term effectiveness of this alternative is higher than Alternative 1, because the removal and capping of sediments in the Whatcom Waterway reduces the potential for impacted sediments to be exposed to aquatic organisms, including benthic organisms, fish and marine mammals. Most Waterway sediments are consolidated in the CAD facility. Residual sediments not removed from the Waterway are contained by a thick sediment cap, providing a barrier against sediment resuspension and aquatic organism exposure. The alternative does not use off-site disposal, treatment or recycling which are the highest-preference technologies under MTCA preference rankings. Alternative 2 provides for a dredge depth in the federal channel consistent with the 1960s federal channel designation, but the effective water depth in berth areas will depend on investments of shoreline property owners and coordination of Waterway cleanup with development actions in those areas. As with all of the alternatives evaluated in the Feasibility Study, Alternative 2 will require appropriate institutional controls to be established as part of the Cleanup Action Plan and project implementation activities.

- **Short-Term Risk Management:** Alternative 2 involves extensive construction activities in most portions of the site. Project design and permitting will need to address appropriate construction activities and safety precautions to manage short-term risks. In particular, dredging activities in the Waterway areas will need to use appropriate environmental dredge methods to minimize water

quality impacts at the point of dredging. Sediment transportation and placement at the CAD site will need to prevent adverse water quality impacts. At the conclusion of each dredging season, appropriate measures will need to be taken to stabilize the CAD site and minimize exposure of wildlife and fisheries resources prior to completion of the CAD in the fourth construction season. The other construction activities of Alternative 2 are similar to those of Alternative 1 and include the capping of the ASB sludges, enhancements to the Log Pond shoreline, and capping of two areas (Unit 5-B and Unit 6-B&C) of impacted sediments. Work in all site areas other than the ASB would be conducted in appropriate "fish windows" to avoid impacts to juvenile salmonids.

- **Implementability:** From a technical standpoint, Alternative 2 is fully implementable. Alternative 2 uses capping, dredging and other construction technologies that are readily available, with experienced contractors available locally and nationally. Regulatory implementability is also favorable, as evidenced by the general support of the Cornwall CAD alternative during the 2000 RI/FS and EIS process. The project is complex, and project permitting and logistical considerations will need to be addressed during project design and permitting. However, the principal implementation challenges for Alternative 2 are associated with land use conflicts. First, the 1960s federal channel boundaries and associated shoreline use restrictions and infrastructure requirements conflict with planned mixed-use redevelopment and habitat enhancements. Second, implementation of Alternative 2 will require complex coordination of Waterway dredging with required shoreline infrastructure investments.

- **Consideration of Public Concerns:** Public review of this RI/FS and of the companion EIS document will be used to solicit public concerns relative to this Alternative. Based on previous public concerns noted during earlier RI/FS, EIS and land use planning activities, potential public concerns relevant to this alternative include: 1) DNR concerns about locating the CAD facility on state-owned aquatic lands, 2) potential permitting concerns with the proposed CAD site construction, 3) conflicts between the planned mixed-use redevelopment and habitat enhancements along the Inner Whatcom Waterway and the requirements of Alternative 2 for industrial shoreline infrastructure and associated land uses. The use of the Cornwall CAD site to optimize the management of dredged materials received generally favorable response during the 2000 EIS process, completed prior to many of the recent land use changes affecting the Bellingham waterfront.

7.2.3 Alternative 3

Alternative 3 uses a combination of institutional controls, monitored natural recovery and containment to achieve compliance with SMS cleanup levels. Alternative 3 uses dredging to remove sediments from the Whatcom Waterway consistent with the dimensions of the 1960s federal navigation channel. These dredged sediments are then managed by creating a nearshore fill within the majority of the ASB. The portion of the ASB not required for the fill would be retained for stormwater or cooling water treatment uses. Alternative 3 is shown in Figure 6-3.

MTCA Threshold Requirements

A comparison of Alternative 3 against applicable MTCA threshold criteria is provided below. This information is summarized in Table 7-1.

If appropriately designed and permitted, Alternative 3 complies with MTCA threshold criteria, as do the other alternatives evaluated in the Feasibility Study.

- **Protection of Human Health and the Environment:** Alternative 3 protects human health and the environment by complying with applicable cleanup standards.

- **Compliance with Cleanup Standards:** Alternative 3 complies with the cleanup standards described in Section 3.1. Cleanup standards are addressed using active containment measures including in-place capping, as well as dredging with containment in an ASB nearshore fill. Design and permitting of the nearshore fill will require appropriate evaluations to ensure compliance with groundwater and surface water cleanup standards. Appropriate institutional controls within the fill area will provide for long-term maintenance of the fill. Alternative 3 does not use monitored natural recovery for areas that remain above applicable cleanup standards. Monitored natural recovery is applied only in areas that already comply with cleanup standards.

- **Compliance with Applicable State & Federal Laws:** Assuming compliance with appropriate project design and permitting requirements this alternative will comply with applicable state and federal laws. Institutional controls will be addressed as part of the final Cleanup Action Plan and Consent Decree and project implementation measures. Land use issues associated with the ASB and waterfront areas would need to be considered as part of the ongoing land use planning process.. The alternative involves the creation of a new sediment disposal site within shoreline areas. Project design and permitting would need to address water quality

protection and other short-term and long-term risks associated with the CAD site development..

- **Provisions for Compliance Monitoring:** Alternative 3 provides for compliance monitoring in cap areas and in areas addressed through monitored natural recovery. Additional monitoring costs are allocated for the ASB fill site.

Restoration Time-Frame

The restoration time-frame for Alternative 3 will be determined by the start-date of construction and by the duration of work activities. As described above, the construction in shoreline areas of the Inner Whatcom Waterway will need to be integrated with shoreline redevelopment actions in order to coordinate sediment dredging with shoreline infrastructure upgrades. Such activities would require substantial funding investments by local property owners and governments, and would also involve substantial design and permitting requirements. As a result, the start-date for construction would likely be at least 2-5 years from the time of Consent Decree approval. Construction activities would likely be completed within 3 years. Therefore, the restoration time-frame for this alternative is estimated at between 5 and 8 years.

MTCA Evaluation Criteria

The MTCA disproportionate cost analysis includes comparative analysis of seven criteria. Issues relevant to the disproportionate costs analysis are discussed below, and are listed in Table 7-1.

- **Overall Protectiveness:** The overall protectiveness of Alternative 3 is achieved through the use of active measures. The dredging and capping in the Whatcom Waterway improves the protectiveness in this area, by reducing the potential that navigation uses in this area will resuspend residual subsurface sediments. Subsurface sediments would remain in some berth and waterway areas where full removal is not feasible, but these areas would be contained with a cap, designed to resist prop wash and to be stable under anticipated wind and wave conditions.

- **Permanence:** Alternative 3 does not reduce the toxicity or volume of sediments or ASB sludges remaining on the waterfront. However, Waterway navigation areas are deepened and capped, reducing the potential for future anthropogenic resuspension of contaminated sediment, and the alternative does consolidate the sediments dredged from the Whatcom Waterway and from the outer portion of the ASB within the ASB fill site. This results in a greater degree of permanence than that in Alternative 1. But conflicts between planned aquatic uses of the ASB are not

addressed under this alternative, resulting in a lower degree of permanence for this area of the site than in other evaluated alternatives (i.e., Alternatives 5 through 8).

- **Remedy Costs and Cost-Effectiveness:** The probable cost of Alternative 3 ($34 million) is approximately the same as that for Alternative 2 (Appendices A and B). The cost is substantially greater than that of Alternative 1. However, it is similar in cost to Alternatives 3 through 6, and substantially less than Alternatives 7 and 8.

- **Long-Term Effectiveness:** Alternative 3 uses a combination of institutional controls, monitored natural recovery and containment to achieve cleanup levels. However, all sediment areas that do not currently meet cleanup levels, and the navigation areas of the Whatcom Waterway are remediated using active measures. Long-term effectiveness of this alternative is higher than Alternative 1, because the removal and capping of sediments in the Whatcom Waterway reduce the potential for impacted sediments to be exposed to aquatic organisms. Most Waterway sediments are consolidated in the ASB facility. Residual sediments not removed from the Waterway are contained by a thick sediment cap, providing a barrier against sediment resuspension and aquatic organism exposure. The alternative does not use off-site disposal, treatment or recycling which are the higher-preference technologies under MTCA preference rankings. Alternative 3 provides for a dredge depth in the federal channel consistent with the 1960s federal channel designation. The effective water depth in berth areas will depend on investments of shoreline property owners and coordination of Waterway cleanup with development actions in those areas. As with all of the alternatives evaluated in the Feasibility Study, Alternative 3 will require appropriate institutional controls to be established as part of the Cleanup Action Plan and project implementation activities.

- **Short-Term Risk Management:** Alternative 3 involves extensive construction activities in the Waterway and harbor areas, but the sediment disposal facility is constructed within the ASB berms,. The ASB berms reduce the short-term construction risks associated with the disposal site over Alternative 2. Project design and permitting will need to address appropriate construction activities and safety precautions to manage short-term risks. In particular, dredging activities in the waterway areas will need to use appropriate environmental dredge methods to minimize water quality impacts at the point of dredging, and sediment transportation and placement at the ASB fill site will need to prevent adverse water quality impacts. If hydraulic dredging is

selected for use with the ASB fill, then the management of produced dredge waters will need to ensure protection of water quality within Bellingham Bay at the point of discharge. The other construction activities of Alternative 3 are similar to those of Alternatives 1 and 2. Work timing in all site areas other than the initial and final activities within the ASB would be established in appropriate "fish windows" to avoid impacts to juvenile salmonids.

- **Implementability:** From a technical standpoint, Alternative 3 is fully implementable. The alternative uses capping, dredging and other construction technologies that are readily available, with experienced contractors available locally and nationally. Administrative implementability would be subject to land-owner approval of the ASB as a future sediment disposal site, which use is in conflict with plans for aquatic reuse of this area. The project involves the creation of a new sediment disposal site within shoreline areas, which may be inconsistent with the provisions of the existing City of Bellingham Shoreline Master Program. As with Alternative 2, the implementation of Alternative 3 will require significant coordination of cleanup activities with infrastructure investments along the Inner Whatcom Waterway shoreline.

- **Consideration of Public Concerns:** Public review of this RI/FS and of the companion EIS document will be used to solicit public concerns relative to this Alternative. Based on previous public concerns noted during earlier RI/FS, EIS and land use planning activities, potential public concerns relevant to this alternative include: 1) concern over the creation of a new nearshore fill site on the Bay, 2) desire by some commenters for alternatives that removed impacted materials including the ASB sludges from the waterfront, 3) inconsistency of the alternative with planned aquatic reuse of the ASB, and 4) conflicts between the dredging plan for the Inner Whatcom Waterway and planned land use and habitat enhancements in this area. Public comments received during previous RI/FS and EIS activities that were generally supportive of Alternative 3 include 1) favoring of the ASB nearshore fill because it reduced the level of in-water construction activities otherwise required at the Cornwall CAD site, and 2) favoring of the ASB nearshore fill because the alternative did not create a new disposal site on state-owned aquatic lands.

7.2.4 Alternative 4

Alternative 4 is the first of the evaluated alternatives that uses upland disposal at a Subtitle D landfill facility rather than on-site containment for management of dredged sediments. Alternative 4 also uses institutional controls, monitored natural recovery and containment to comply with SMS cleanup levels. Under

Alternative 4, Waterway dredging is performed consistent with the multi-purpose channel dimensions (refer to discussion in Section 4.2.2) and ASB sludges are capped in place. Alternative 4 is shown in Figure 6-4.

MTCA Threshold Requirements

A comparison of Alternative 4 against applicable MTCA criteria is provided below. This information is also summarized in Table 7-1. Alternative 4 complies with MTCA threshold criteria, as do the other alternatives evaluated in the Feasibility Study.

- **Protection of Human Health and the Environment**: Alternative 4 protects human health and the environment by complying with applicable cleanup standards.

- **Compliance with Cleanup Standards:** Alternative 4 complies with the cleanup standards described in Section 3.1. Cleanup standards are addressed using removal and upland disposal, combined with active containment measures including thick sediment capping. Alternative 4 does not use monitored natural recovery for areas that remain above applicable cleanup standards. Monitored natural recovery is applied only in areas that already comply with cleanup standards.

- **Compliance with applicable state & federal laws:** Assuming compliance with appropriate project design and permitting requirements this alternative will comply with applicable state and federal laws. Institutional controls will be addressed as part of the final Cleanup Action Plan and Consent Decree. Land use issues associated with the Waterway modifications would be considered as part of the ongoing land use planning process, project design and permitting and the site institutional controls framework.

- **Provisions for Compliance Monitoring:** Alternative 4 provides for compliance monitoring in cap areas and in areas addressed through monitored natural recovery.

Restoration Time-Frame

The restoration time-frame for Alternative 4 will be determined predominantly by the start-date of construction. As described above, the construction activities can likely be completed within approximately 1 year. The project will involve significant design and permitting issues, but will not be subject to delays associated with funding, design and permitting of shoreline redevelopment actions as under Alternative 2 or 3. Approximately 2 years is assumed for completion of design and permitting. Therefore, the restoration time-frame for this alternative is estimated at between 3 and 4 years.

MTCA Evaluation Criteria

The MTCA disproportionate cost analysis includes comparative analysis of seven criteria. Issues relevant to the disproportionate costs analysis are discussed below, and are listed in Table 7-1.

- **Overall Protectiveness:** The overall protectiveness of Alternative 4 is achieved through the use of active measures. It is higher than that of Alternative 1, and similar to that of Alternatives 2 and 3. The dredging and capping in the Whatcom Waterway ensures protectiveness in this area, by reducing the potential that navigation uses in this area will resuspend residual subsurface sediments. The establishment of consistent waterway depths and stable side-slopes reduces risks of recontamination from future construction activities or shoreline erosion. Subsurface sediments would remain in some berth and Waterway areas, but these areas would be contained with a thick cap, designed to resist prop wash and to be stable under anticipated wind and wave conditions.

- **Permanence:** Alternative 4 reduces the volume of sediments remaining on the waterfront, managing these dredged sediments by upland disposal at off-site permitted Subtitle D facilities. Waterway navigation areas are deepened and capped, and shorelines are stabilized consistent with current land use planning for this area, reducing the potential for future anthropogenic resuspension of contaminated sediments. This results in a greater degree of permanence than that in Alternatives 1 through 4. However, the alternative uses containment for management of the ASB sludges, resulting in conflicts between planned aquatic uses of the ASB and this alternative. The permanence of Alternative 4 is lower than that of other evaluated alternatives (i.e., Alternatives 5 through 8).

- **Remedy Costs and Cost-Effectiveness:** The probable cost of Alternative 4 ($21 million) is lower than that of Alternatives 2 and 3 which have similar degrees of permanence (Appendices A and B). Alternative 2 is the least costly of the alternatives incorporating sediment disposal in an off-site, permitted, Subtitle D facility.

- **Long-Term Effectiveness:** Alternative 4 uses a combination of institutional controls, monitored natural recovery, containment and Subtitle D disposal to achieve cleanup levels. All sediment areas that do not currently meet cleanup levels and the navigation areas of the Whatcom Waterway are remediated using active measures. However, the long-term effectiveness of the alternative is not as high as other alternatives that make greater use of Subtitle D disposal. Residual sediments not removed from the Waterway are contained by a thick sediment cap, providing a barrier against

sediment resuspension and aquatic organism exposure. The alternative does not use treatment or recycling which are the highest preference technologies under MTCA preference rankings. As with all of the alternatives evaluated in the Feasibility Study, Alternative 4 will require appropriate institutional controls to be established as part of the Cleanup Action Plan and project implementation activities.

- **Short-Term Risk Management:** Alternative 4 involves a moderate level of in-water construction activities. Project design and permitting will need to address appropriate construction activities and safety precautions to manage short-term risks. In particular, dredging activities in the waterway areas will need to use appropriate environmental dredge methods to minimize water quality impacts at the point of dredging, and at sediment offloading locations. Stormwater controls will need to be applied for upland sediment staging areas. The use of rail for shipment of sediments to the disposal site will minimize traffic impacts and associated risks. The other construction activities of Alternative 2 are similar to those of Alternative 1 and include the capping of the ASB sludges, enhancements to the Log Pond cap, and capping of two areas (Unit 5-B and Unit 6-B&C) of impacted sediments. Work timing in all site areas other than the ASB would be established in appropriate "fish windows" to avoid impacts to juvenile salmonids.

- **Implementability:** From a technical standpoint, Alternative 4 is fully implementable. The alternative uses capping, dredging, and common transportation and disposal technologies that are readily available, with experienced contractors available locally and nationally. The dredging and shoreline stabilization concepts applied in the Inner Whatcom Waterway areas under this Alternative are consistent with land use, navigation and habitat enhancement planning for this area. Alternative 4 provides for reduced shoreline infrastructure requirements relative to Alternatives 2 and 3, greatly simplifying and expediting project implementation. However, the capping of the ASB sludges under Alternative 4 conflicts with the planned aquatic reuse of this area.

- **Consideration of Public Concerns:** Public review of this RI/FS and of the companion EIS document will be used to solicit public concerns relative to this Alternative. Based on public concerns noted during earlier RI/FS, EIS and land use planning activities, potential public concerns relevant to this alternative include: 1) conflicts between capping of the ASB and planned aquatic reuse of this area, and 2) a desire by some commenters for greater use of upland disposal for management of contaminated sediments and ASB sludges. The alternative is anticipated to be generally

consistent with pubic land use priorities for the Inner Whatcom Waterway and Bellingham Shipping Terminal areas.

7.2.5 Alternative 5

Alternative 5 uses multiple technologies to comply with SMS cleanup levels. Removal, treatment for volume reduction, and upland disposal are used for ASB sludges. The remediated ASB is then reconnected with the surface waters of Bellingham Bay, and clean berm materials are reused as part of the cleanup action in other areas of the site. Waterway dredging is conducted consistent with the multi-purpose channel concept (refer to discussion in Section 4.2.2), with dredged sediments managed by upland disposal. Institutional controls, monitored natural recovery and containment are used in various portions of the site. Alternative 5 is shown in Figure 6-5.

MTCA Threshold Requirements

A comparison of Alternative 5 against applicable MTCA criteria is provided below. This information is summarized in Table 7-1. Alternative 5 complies with MTCA threshold criteria, as do the other alternatives evaluated in the Feasibility Study.

- **Protection of Human Health and the Environment**: Alternative 5 protects human health and the environment by complying with applicable cleanup standards.

- **Compliance with Cleanup Standards:** Alternative 5 complies with the cleanup standards described in Section 3.1. Cleanup standards are addressed using removal, treatment and upland disposal, combined with active containment measures including thick sediment capping. Alternative 5 does not use monitored natural recovery for areas that remain above applicable cleanup standards. Monitored natural recovery is applied only in areas that already comply with cleanup standards.

- **Compliance with Applicable State & Federal Laws**: **Assuming** compliance with appropriate project design and permitting requirements this alternative will comply with applicable state and federal laws. Institutional controls will be addressed as part of the final Cleanup Action Plan and Consent Decree. Land use issues associated with the Waterway modifications would be considered as part of the ongoing land use planning process, project design and permitting and the site institutional controls framework.

- **Provisions for Compliance Monitoring:** Alternative 5 provides for compliance monitoring in cap areas and in areas addressed through monitored natural recovery.

Restoration Time-Frame

The restoration time-frame for Alternative 5 will be determined by both the start-date of construction and the duration of construction activities. The project will involve significant design and permitting issues, but will not be subject to delays associated with funding, design and permitting of shoreline redevelopment actions as under Alternative 2 or 3. Approximately 2 years is assumed for completion of design and permitting. Construction activities will likely require 3 to 4 years for completion. Therefore, the restoration time-frame for this alternative is estimated at between 5 and 6 years.

MTCA Evaluation Criteria

The MTCA disproportionate cost analysis includes comparative analysis of seven criteria. Issues relevant to the disproportionate costs analysis are discussed below, and are listed in Table 7-1.

- **Overall Protectiveness:** The protectiveness of Alternative 5 is achieved through the use of active measures. Dredging, treatment and upland disposal at off-site, permitted Subtitle D facilities are used for remediation of the ASB, increasing the level of overall protectiveness of this Alternative relative to Alternatives 1 through 4. The dredging, capping and shoreline stabilization actions in the Whatcom Waterway ensures protectiveness in this area, by reducing the potential that navigation uses in this area will resuspend residual subsurface sediments. The establishment of consistent waterway depths and stable side-slopes reduces risks of recontamination from future construction activities or shoreline erosion. Subsurface sediments would remain in some berth and waterway areas, but these areas would be contained with a cap, designed to resist prop wash and to be stable under anticipated wind and wave conditions.

- **Permanence:** Alternative 5 removes the ASB sludges, the most impacted of the contaminated materials requiring remediation. These sediments will be treated to reduce their volume prior to disposal. Removal of the ASB sludges increases the permanence of this Alternative. Sediments dredged from the Waterway areas will be managed by dredging and upland disposal. Low-level impacted sediments within deeper portions of the waterway will be managed by in-place containment, using a thick cap to ensure long-term protection of aquatic organisms. Alternative 4 has greater consistency with area land use, navigation and habitat enhancement planning than Alternatives 1 through 4, further increasing remedy permanence.

- **Remedy Costs and Cost-Effectiveness:** The probable costs of Alternative 5 ($42 million) are higher than those of Alternatives 1

through 4 (Appendices A and B). The higher costs of this alternative are principally associated with the removal, treatment and disposal of the ASB sludges. Alternative 5 is the lowest cost alternative that includes removal of the ASB sludges from the waterfront. The costs of Alternative 5 are similar to those of Alternative 6, and substantially less than those of Alternatives 7 and 8.

- **Long-Term Effectiveness:** Alternative 5 uses a hybrid remedy including a full range of remedial technologies. Those technologies include recycling, treatment, upland disposal, containment, natural recovery and institutional controls. All sediment areas that do not currently meet cleanup levels, and the navigation areas of the Whatcom Waterway are remediated using active measures. Residual sediments not removed from the Waterway are contained by a thick sediment cap, providing a barrier against sediment resuspension and aquatic organism exposure. By removing the ASB sludges, Alternative 5 allows for recycling of the clean ASB berm materials. A portion of the material is used as part of the capping and shoreline stabilization under the Alternative, and additional materials will be available and may be used in subsequent habitat enhancement and/or redevelopment actions. As with all of the alternatives evaluated in the Feasibility Study, Alternative 5 will require appropriate institutional controls to be established as part of the Cleanup Action Plan and project implementation activities.

- **Short-Term Risk Management:** Alternative 5 involves a complex, three-phase construction sequence. However, only the first and third phases of construction take place within the aquatic environment. The second phase of construction will take place within the ASB, prior to opening of the ASB berm. This will reduce the short-term risks to the extent possible. Project design and permitting will need to address appropriate construction activities and safety precautions to manage short-term risks. Dredging activities in the Waterway areas will need to use appropriate environmental dredge methods to minimize water quality impacts at the point of dredging, and at sediment offloading locations. Stormwater controls will need to be applied for upland sediment staging areas. The use of rail for shipment of sediments to the disposal site will minimize traffic impacts and associated risks. The phasing of all in-water construction activities will be timed to minimize impacts to juvenile salmonids and other aquatic organisms.

- **Implementability:** From a technical standpoint, Alternative 5 is fully implementable. The alternative uses capping, dredging, and

common transportation and disposal technologies that are readily available, with experienced contractors available locally and nationally. The treatment technologies applied under this alternative are well-established methods of dewatering sludges from wastewater treatment impoundments and other sludge impoundments and have been applied during previous ASB maintenance activities by Georgia Pacific. The dredging and shoreline stabilization concepts applied in the Inner Whatcom Waterway areas under this Alternative are consistent with land use, navigation and habitat enhancement planning for this area, improving administrative implementability. Alternative 5 provides for reduced shoreline infrastructure requirements relative to Alternatives 2 and 3, greatly simplifying and expediting project implementation. Alternative 5 also remediates the ASB, enabling aquatic reuse of this area consistent with land use planning activities and land-owner objectives.

- **Consideration of Public Concerns:** Public review of this RI/FS and of the companion EIS document will be used to solicit public concerns relative to this Alternative. Based on public concerns noted during earlier RI/FS, EIS and land use planning activities, potential public concerns relevant to this alternative are mainly associated with the maximizing the use of dredging and upland disposal for management of contaminated sediments. However, public comment in favor of the alternative is considered likely based on the alignment of dredging and shoreline stabilization planning for the Inner Whatcom Waterway with previous public comments regarding land use, navigation and habitat enhancement priorities for this area. Similarly, remediation of the ASB accommodates plans for aquatic reuse of this area, consistent with previous public comments and land-owner objectives. Alternative 5 also preserves the flexibility for deep draft uses at the Bellingham Shipping terminal. For these reasons, and due to the greater use of dredging and upland disposal, Alternative 5 is considered likely to address public concerns better than Alternative 4.

7.2.6 Alternative 6

Cleanup Alternative 6 is in most respects the same as Alternative 5. The difference between the alternatives, is that under Alternative 6 additional dredging is conducted adjacent to the Bellingham Shipping Terminal. Other features of the Alternative, including the cleanout of the ASB and the remedial approach to the Inner Whatcom Waterway and Harbor areas are the same as in Alternative 5.

MTCA Threshold Requirements

A comparison of Alternative 6 against applicable MTCA criteria is provided below. This information is summarized in Table 7-1. As with Alternative 5, Alternative 6 complies with all MTCA threshold criteria.

- **Protection of Human Health and the Environment**: Alternative 6 protects human health and the environment by complying with applicable cleanup standards.

- **Compliance with Cleanup Standards:** Alternative 6 complies with the cleanup standards described in Section 3.1. Cleanup standards are addressed using removal, treatment and upland disposal, combined with active containment measures including thick sediment capping. Alternative 6 does not use monitored natural recovery for areas that remain above applicable cleanup standards. Monitored natural recovery is applied only in areas that already comply with cleanup standards.

- **Compliance with Applicable State & Federal Laws:** Assuming compliance with appropriate project design and permitting requirements this alternative will comply with applicable state and federal laws. Institutional controls will be addressed as part of the final Cleanup Action Plan and Consent Decree and project implementation steps. Land use issues associated with the Waterway modifications would be addressed as part of the ongoing land use planning process, project design and permitting and the site institutional controls framework.

- **Provisions for Compliance Monitoring:** Alternative 6 provides for compliance monitoring in cap areas and in areas addressed through monitored natural recovery.

Restoration Time-Frame

The restoration time-frame for Alternative 6 is estimated to be the same as for Alternative 5. Approximately 2 years will be required for design and permitting of the cleanup. Construction activities will occur in three phases and will take approximately 3 to 4 years to complete. The total restoration time-frame is therefore estimated at 5 to 6 years from the date of the Consent Decree.

MTCA Evaluation Criteria

The MTCA disproportionate cost analysis includes comparative analysis of seven criteria. Issues relevant to the disproportionate costs analysis are discussed below, and are listed in Table 7-1.

- **Overall Protectiveness:** The protectiveness of Alternative 6 is slightly higher than that of Alternative 5. The increased protectiveness is obtained by increasing removal and upland disposal in deep draft navigation areas near the Bellingham Shipping Terminal. Other aspects of the remedy are the same as Alternative 5.

- **Permanence:** Alternative 6 removes the ASB sludges, the most impacted of the contaminated materials requiring remediation. These sediments will be treated to reduce their volume prior to disposal. Sediments dredged from the Waterway areas will be managed by dredging and upland disposal. Low-level impacted sediments within the Inner Whatcom Waterway that do not conflict with future navigation uses will be managed by in-place containment. The consistency of Alternative 6 with area land use, navigation and habitat enhancement planning increases the permanence of this remedy relative to Alternatives 1 through 4, which do not exhibit this land use consistency.

- **Remedy Costs and Cost-Effectiveness:** The probable costs of Alternative 6 are $44 million, slightly higher than those of Alternative 5, and significantly greater than those of Alternatives 1 through 4. The additional costs (in comparison to Alternative 5) are associated with the greater use of dredging and upland disposal for sediment management under this alternative (Appendices A and B).

- **Long-Term Effectiveness:** Alternative 6 uses a hybrid remedy with a full range of remedial technologies. Those technologies include recycling, treatment, upland disposal, containment, natural recovery and institutional controls. All sediment areas that do not currently meet cleanup levels, and the navigation areas of the Whatcom Waterway are remediated using active measures. Residual sediments not removed from the Waterway are contained by a thick sediment cap, providing a barrier against sediment resuspension and aquatic organism exposure. Alternative 6 also provides for reuse of clean berm materials from the ASB for capping and habitat enhancement activities.

- **Short-Term Risk Management:** Alternative 6 involves additional dredging near the Bellingham Shipping Terminal, over that provided in Alternative 5. The additional dredging slightly increases the degree of short-term risk associated with the cleanup alternative. However, the incremental risks can be managed through appropriate design and construction practices and design of the cleanup to accommodate geotechnical and structural integrity limitations at the Bellingham Shipping Terminal.

- **Implementability:** From a technical and administrative standpoint, Alternative 6 is fully implementable. Most project elements are the same as Alternative 5. Consistency of Alternative 6 with area land use planning for the Whatcom Waterway and for the ASB enhance remedy implementability in comparison with Alternatives 1 through 4 which do not share this consistency. The differences in dredge elevations at the Shipping Terminal increase the technical complexity of the project, but facilitate long-term management of the deep draft Waterway areas.

- **Consideration of Public Concerns:** Public review of this RI/FS and of the companion EIS document will be used to solicit public concerns relative to this Alternative. Based on public concerns noted during earlier RI/FS, EIS and land use planning activities, potential public concerns relevant to this alternative are mainly associated with the maximizing the use of dredging and upland disposal for management of contaminated sediments. Public comment in favor of the Alternative 6 is considered likely based on the alignment of dredging and shoreline stabilization planning for the Inner Whatcom Waterway with previous public comments regarding land use, navigation and habitat enhancement priorities for this area. Similarly, remediation of the ASB accommodates plans for aquatic reuse of this area, consistent with previous public comments and land-owner objectives. Alternative 6 also provides additional contaminated sediment removal in the vicinity of the Bellingham Shipping terminal in comparison to Alternatives 4 and 5. Alternative 6 is considered likely to address public concerns better than Alternatives 4 and 5.

7.2.7 Alternative 7

Alternative 7 uses the same technologies as Alternatives 5 and 6 to comply with cleanup levels. These include institutional controls, monitored natural recovery, containment, removal and disposal, treatment and reuse & recycling. Unlike Alternatives 5 and 6, Alternative 7 dredges sediments from the Inner Whatcom Waterway consistent with the 1960s industrial channel. Alternative 7 is shown in Figure 6-7.

MTCA Threshold Requirements

A comparison of Alternative 7 against applicable MTCA criteria is provided below. This information is also summarized in Table 7-1. Alternative 7 complies with MTCA threshold criteria, as do the other alternatives evaluated in the Feasibility Study.

- **Protection of Human Health and the Environment**: Alternative 7 protects human health and the environment by complying with applicable cleanup standards.

- **Compliance with Cleanup Standards:** Alternative 7 complies with the cleanup standards described in Section 3.1. Cleanup standards are addressed using removal, treatment and upland disposal, combined with active containment measures including thick sediment capping. Alternative 7 does not use monitored natural recovery for areas that remain above applicable cleanup standards. Monitored natural recovery and institutional controls are applied only in areas that already comply with cleanup standards for surface sediments.

- **Compliance with Applicable State & Federal Laws:** Assuming compliance with appropriate project design and permitting requirements this alternative will comply with applicable state and federal laws. Institutional controls will be addressed as part of the final Cleanup Action Plan, Consent Decree and project implementation. Land use issues associated with the Waterway dredging and required shoreline infrastructure upgrades would be considered as part of the ongoing land use planning process, project design and permitting and the site institutional controls framework.

- **Provisions for Compliance Monitoring:** Alternative 7 provides for compliance monitoring in cap areas and in areas addressed through monitored natural recovery.

Restoration Time-Frame

The restoration time-frame for Alternative 7 will be determined by both the start-date of construction and the sequence and duration of construction activities. The project will involve significant design and permitting issues, and will require coordination between the cleanup activities and the development of shoreline infrastructure improvements along the Inner Whatcom Waterway. The period required for design and permitting is estimated at between 3 to 5 years, including the integrated infrastructure planning. Construction activities are estimated to require 4 years to complete. The project construction activities would be completed in three phases, similar to Alternative 6, but in-water work activities would be required in all three construction phases, not just during the first and third. The additional in-water construction period is required to provide for dredging and shipment of the incremental sediment volume under Alternative 7. The total restoration time-frame for Alternative 7 is therefore estimated at between 7 and 9 years from the date of the Consent Decree.

MTCA Evaluation Criteria

The MTCA disproportionate cost analysis includes comparative analysis of seven criteria. Issues relevant to the disproportionate costs analysis are discussed below, and are listed in Table 7-1.

- **Overall Protectiveness:** The protectiveness of Alternative 7 is achieved through the use of active measures. Dredging, treatment and upland disposal in an off-site, permitted Subtitle D facility are used for remediation of the ASB area. Dredging in areas of the Whatcom Waterway is expanded under the alternative to support full dredging of the 1960s industrial channel, including in the Inner Waterway area. This dredging removes some additional impacted material from the Waterway, with capping of residual sediments at elevations 5 feet below the historical channel depths. This additional removal provides additional deepening of the area that can be used for navigation, though residual sediments with similar contaminant levels will remain under both alternatives, and the concentrations of sediment constituents in those residuals are already low relative to other materials (ASB sludges) removed under Alternatives 5 and 6. The benefits of additional contaminant removal are also offset by the increased levels of short-term risk, and by the negative impacts to land use and habitat conditions in the Waterway. Management of areas outside of the Whatcom Waterway is identical to that under Alternatives 5 and 6, with no change in overall protectiveness in these areas.

- **Permanence:** Alternative 7 provides some additional reduction in the total volume of subsurface sediments remaining within the site. However, the additional materials removed under the alternative are relatively low in contaminant concentrations. Further, the alternative provides no significant reductions in site areas that are subject to capping, future monitoring or institutional control requirements.

- **Remedy Costs and Cost Effectiveness:** The probable costs of Alternative 7 ($74 million) are significantly greater than those of Alternative 6 ($44 million) or any of the preceding alternatives. They are roughly half of the cost of the most expensive alternative (Alternative 8, $145 million) evaluated in the Feasibility Study (Appendices A and B). Relative to Alternative 6, the additional costs of Alternative 7 are associated with the additional volume of contaminated sediment managed by dredging and upland disposal in order to achieve a final channel depth consistent with the historic industrial channel dimensions in the Inner Whatcom Waterway. These remedy costs do not include the additional costs associated with development of shoreline infrastructure in the Inner Whatcom Waterway (bulkheads, wharves and hardened shorelines) in order to access berth-area contamination and utilize water depths.

- **Long-Term Effectiveness:** Alternative 7 uses a greater degree of upland disposal than the preceding alternatives. However, like the

preceding alternatives, the remedy relies on institutional controls, monitored natural recovery and containment to achieve cleanup levels. The overall footprint of these containment and institutional control areas is not significantly reduced, and the incremental degree of contaminant concentration reduction achieved for the residual sediments is small relative to that achieved by the preceding alternatives. For these reasons, the long-term effectiveness of Alternative 7 is considered similar to that of Alternative 6. The long-term effectiveness of Alternative 7 will also be affected by the coordinated matching of shoreline infrastructure to dredging patterns in the Waterway. If these actions are not coordinated, then the side-slopes of the Waterway will not be stable or usable for navigation, and the potential for waterway recontamination to occur will be greater.

- **Short-Term Risk Management:** Alternative 7 involves an increase in the in-water construction activities required for Waterway cleanup. A third in-water construction season will be required to complete dredging in the Waterway. This increases by 50% the level of short-term risks that must be managed under the alternative. Project design and permitting will need to address appropriate construction activities and safety precautions to manage short-term risks. Dredging activities in the waterway areas will need to use appropriate environmental dredge methods to minimize water quality impacts at the point of dredging, and at sediment offloading locations. Stormwater controls will need to be applied for upland sediment staging areas. The use of rail for shipment of sediments to the disposal site will minimize traffic impacts and associated risks. The phasing of all in-water construction activities will be timed to during the appropriate "fish windows" to avoid impacts to juvenile salmonids and other aquatic organisms.

- **Implementability:** As with Alternatives 2 and 3, the implementability of Alternative 7 will depend primarily on the ability to coordinate cleanup dredging with upgrades to shoreline infrastructure in the Inner Waterway. Given the transition in area land uses that has been occurring and the current plans for development of mixed-uses and habitat enhancements along the Inner Waterway area, it is unlikely that the infrastructure investment and use limitations required to fully dredge and maintain the 1960s federal channel will be forthcoming. This issue is discussed further as part of the companion EIS document.

- **Consideration of Public Concerns:** Public review of this RI/FS and of the companion EIS document will be used to solicit public concerns relative to this Alternative. Based on previous public concerns noted during earlier RI/FS, EIS and land use planning

activities, potential public concerns relevant to this alternative include: 1) desires by some commenters to increase the use of dredging and upland disposal beyond that used in Alternative 7, 2) concerns about conflicts between planned area land uses and the proposed dredging patterns and infrastructure requirements for the Inner Whatcom Waterway, and 3) concerns about destruction of emergent shallow-water habitat at the head and along the sides of the Inner Whatcom Waterway.

7.2.8 Alternative 8

Alternative 8 manages most site cleanup areas through sediment removal and upland disposal. The Alternative uses the same range of technologies evaluated for Alternatives 5, 6 and 7 to comply with SMS cleanup levels. However, the extent of dredging and upland disposal is expanded under Alternative 8 relative to the preceding alternatives. Alternative 8 conducts removal and upland disposal for ASB sludges, and for sediments dredged from the Whatcom Waterway 1960s industrial channel. In addition, Alternative 8 also removes sediments located in outlying portions of the site, including areas addressed by capping and monitored natural recovery under other alternatives. Alternative 8 is shown in Figure 6-8.

MTCA Threshold Requirements

A comparison of Alternative 8 against applicable MTCA criteria is provided below. This information is summarized in Table 7-1. Alternative 8 complies with MTCA threshold criteria, as do the other alternatives evaluated in the Feasibility Study.

- **Protection of Human Health and the Environment**: Alternative 8 protects human health and the environment by complying with applicable cleanup standards.

- **Compliance with Cleanup Standards:** Alternative 8 complies with the cleanup standards described in Section 3.1, primarily through the use of dredging and upland disposal. The use of capping and institutional controls is limited to management of residual contamination beneath the planned dredge depth in the Inner Whatcom Waterway.

- **Compliance with Applicable State & Federal Laws:** Assuming compliance with appropriate project design and permitting requirements this alternative will comply with applicable state and federal laws. Institutional controls will be addressed as part of the final Cleanup Action Plan, Consent Decree and project implementation actions. Land use issues associated with the Waterway dredging and required shoreline infrastructure upgrades would be considered as part of the ongoing land use planning

process, project design & permitting, and the site institutional controls framework.

- **Provisions for Compliance Monitoring:** Alternative 8 provides for compliance monitoring in areas where removal of all sediments is not practicable, and capping of residual sediments is likely to be required.

Restoration Time-Frame

The restoration time-frame for Alternative 8 is relatively long due to the extensive design and permitting, and due to the anticipated duration of site construction activities. It is likely that the restoration time-frame will exceed the SMS preference for a restoration time-frame less than 10 years. The total restoration time-frame is estimated to be between 8 and 13 years from the date of the Consent Decree.

MTCA Evaluation Criteria

The MTCA disproportionate cost analysis includes comparative analysis of seven criteria. Issues relevant to the disproportionate costs analysis are discussed below, and are listed in Table 7-1.

- **Overall Protectiveness:** The protectiveness of Alternative 8 is achieved primarily through the aggressive use of removal and upland disposal. Alternative measures are used only in limited areas. This remedy represents the most permanent remedy evaluated in the Feasibility Study, and represents the initial remedy against which other alternatives are compared in the analysis of disproportionate cost analysis (Section 7.3). The use of institutional controls and containment is still required under this alternative. The additional sediments removed under Alternative 8 (relative to preceding alternatives) are obtained from outlying site areas have the lowest contaminant concentrations of all site materials. Many of the benefits of further reductions in residual sediment concentrations and volumes are offset by the extensive increase in short-term risks associated with the construction of the remedy. Benefits of additional contaminant removal are also offset by the negative impacts to land use and habitat conditions within the project area as discussed in the Draft Supplemental EIS. The overall protectiveness of Alternative 8 is considered similar to that of Alternative 7.

- **Permanence:** Alternative 8 provides the greatest reduction in the total volume of subsurface sediments remaining within the site, and makes the greatest use of permanent solutions of any alternatives evaluated in the Feasibility Study. It therefore provides the basis for evaluation of the relative costs and benefits

of the other alternatives in the analysis of disproportionate costs (Section 7.3).

- **Remedy Costs and Cost Effectiveness:** The probable costs of Alternative 8 ($146 million) are the highest of the eight evaluated alternatives (Appendices A and B). The costs are roughly twice those of the second most costly alternative (Alternative 7, $74 million). The incremental costs are associated with the costs of using dredging and upland disposal rather than capping, monitored natural recovery and institutional controls for management of contaminated sediments outside of the Whatcom Waterway. As with Alternative 7, the costs of Alternative 8 exclude the costs of providing additional shoreline infrastructure in the Inner Whatcom Waterway (bulkheads, wharves and hardened shorelines) in order to access berth-area contamination and utilize water depths.

- **Long-Term Effectiveness:** Alternative 8 uses a greatest degree of dredging and upland disposal of all of the evaluated alternatives. The long-term effectiveness of the alternative is therefore considered to be high, due to the increased use of high-preference remediation technologies as defined under MTCA. The Alternative also provides the smallest areas requiring containment and institutional controls. The long-term effectiveness of Alternative 8 depends in part on the matching of shoreline infrastructure in the Inner Whatcom Waterway to dredging patterns. If these actions are not coordinated, then the side-slopes of the Waterway will not be stable or usable for navigation, and the potential for waterway recontamination to occur will be greater.

- **Short-Term Risk Management:** Alternative 8 involves the greatest in-water construction and the greatest level of short-term risks requiring management. Work activities will take place over the course of 5 to 7 construction seasons, with in-water construction during each of those seasons. Project design and permitting for this alternative will have the greatest challenge to control construction risks throughout the project life-cycle.

- **Implementability:** As with Alternatives 2, 3, and 7 the implementability of Alternative 8 will depend primarily on the ability to coordinate cleanup dredging with upgrades to shoreline infrastructure in the Inner Whatcom Waterway. Given the significant conflicts between the waterway dredging plan and the planned mixed-use redevelopment and nearshore habitat enhancements in this area, it is unlikely that the infrastructure investment and land use restrictions required to fully dredge and maintain the 1960s federal channel will be forthcoming. This conflict may pose implementation problems for this remedy. The

very high cost and the significant duration of the project also create concerns regarding the ability to fully implement this alternative. The implementability of this alternative is considered less than that of Alternative 7.

- **Consideration of Public Concerns:** Public review of this RI/FS and of the companion EIS document will be used to solicit public concerns relative to this Alternative. Based on previous public concerns noted during earlier RI/FS, EIS and land use planning activities, potential public concerns relevant to this alternative include: 1) concerns about conflicts between planned area land uses and the proposed dredging patterns and infrastructure requirements for the Inner Whatcom Waterway, and 2) concerns about destruction of emergent shallow-water habitat at the head and along the sides of the Inner Whatcom Waterway. Conversely, Alternative 8 is likely to appeal to commenters who desire the maximum use of removal and upland disposal technologies as part of the site cleanup, and for whom costs and land use conflicts are less of a concern.

7.3 MTCA Disproportionate Cost Analysis

As discussed in Section 7.1.3, MTCA requirements for remedy selection include the requirement to use permanent solutions to the maximum extent practicable. Permanent cleanup actions are defined under MTCA as those in which cleanup standards can be met without further action being required.

MTCA defines that the evaluation of whether or not a cleanup action uses permanent solutions to the "maximum extent practicable" should be based on a disproportionate cost analysis, consistent with the requirements of WAC 173-340-360(e). In that analysis, cleanup alternatives are arranged from most to least permanent, based on the criteria contained in WAC 173-340-360(f).

The disproportionate cost analysis then compares the relative environmental benefits of each alternative against those provided by the most permanent alternative evaluated. The assessment of benefits can be qualitative as well as quantitative. Costs are disproportionate to benefits if the incremental costs of the more permanent alternative exceed the incremental degree of benefits achieved by the other lower-cost alternative (WAC 173-340-360(e)(i)). Alternatives which exhibit such disproportionate costs are considered "impracticable".

Where the quantitative and qualitative benefits of two alternatives are equivalent, MTCA specifies that department shall select the less costly alternative (WAC 173-340-360(e)(ii)(c)).

The analysis of disproportionate costs is performed below, using the information from Section 7.2 and Table 7-1. First, the alternatives are

compared to the most permanent remedial alternative evaluated (Alternative 8), and the benefits of each alternative are ranked under the criteria of the disproportionate cost analysis (WAC 173-340-360(f)). Then in Section 7.3.2, the costs are compared against these benefits and the relationship between costs and benefits determined. This analysis then defines which alternatives represent the most permanent, practicable alternatives under MTCA.

7.3.1 Comparative Evaluation of Alternatives

The evaluation of disproportionate cost is based on a comparative analysis of costs against six other criteria. Relative rankings of each alternative for these six criteria are summarized in Table 7-2. These rankings are summarized below.

Overall Protectiveness

Overall protectiveness is a parameter that considers many factors. First, it considers the extent to which human health and the environment are protected and the degree to which overall risks at a site are reduced. Both on-site and off-site risks resulting from implementing the alternative are considered. The parameter also expresses the degree to which the cleanup action may perform to a higher level than specific standards in MTCA. Finally, it measures the improvement of the overall environmental quality at the site.

The overall protectiveness of Alternative 1 relies solely on the use of containment and natural recovery processes. Incremental protections present in the other alternatives are not used. Natural recovery is used both to comply with cleanup levels (i.e., to achieve compliance with cleanup standards in areas not currently meeting those standards) as well as to maintain protection in previously-recovered areas. Navigation activities in Waterway areas could trigger sediment recontamination events under this Alternative. Based on these factors, the overall protectiveness of Alternative 1 receives a low ranking.

Overall protectiveness rankings for Alternatives 2, 3 and 4 are medium. These Alternatives use active measures to address contamination within the Waterway. These measures improve protectiveness substantially relative to Alternative 1, by removing the sediments from the navigation channel areas where anthropogenic disturbances are considered likely to occur. However, Alternatives 2 and 3 both involve extensive deep dredging within the Inner Whatcom Waterway beyond that necessary to remove this re-exposure risk, and both involve creation of new sediment disposal sites on the waterfront with their own long-term management risks. Short-term construction risks associated with the deep dredging and disposal site creation reduce the overall protectiveness of Alternatives 2 and 3. These types of risks are described in detail below (see Short-Term Risk Management), and include risks to water quality, risks of sediment recontamination, and safety risks associated with implementation of a large and complex construction project. Further, these

alternatives do not make use of upland disposal, a high-preference remedial strategy under MTCA. Alternative 4 uses upland disposal in off-site, permitted Subtitle D disposal facilities for management of dredged materials generated from the Waterway, rather than creation of a new disposal site. However, Alternative 4 does not use this technology to the extent applied under other Alternatives, and does not apply this technology to the ASB sludges, the most contaminated of the remaining materials requiring cleanup.

The overall protectiveness rankings for Alternatives 5 and 6 are high. Like Alternatives 2, 3 and 4, these alternatives remove contaminated sediments from areas of the Whatcom Waterway where the potential for re-exposure of contaminated materials due to navigation or land use conflicts is considered significant. The protectiveness of Alternatives 5 and 6 is further enhanced by the removal of the ASB sludges from the waterfront. These are the most heavily impacted materials requiring cleanup. Alternatives 5 and 6 use active measures to manage remediation in the Waterway. The establishment of consistent waterway depths and stable side-slopes reduces risks of recontamination from future construction activities or shoreline erosion. Subsurface sediments would remain at depth in some berth and waterway areas, but these areas would be contained with a thick cap, designed to resist prop wash and to be stable under area wind and wave conditions. The protectiveness of Alternative 6 is slightly higher than Alternative 5, because removal and upland disposal is expanded in deep draft navigation areas of Unit 1-C.

The overall protectiveness of Alternative 7 is also high, but on balance is not significantly higher than that provided by Alternatives 5 and 6. The Alternative makes extensive use of active remediation, and aggressive use of off-site disposal. Dredging in areas of the Whatcom Waterway is expanded under the alternative to full deep dredging of the 1960s federal channel. This dredging removes some additional impacted material from the Waterway. This additional removal provides little in the way of additional risk reduction, because the deep sediment is not at risk of re-exposure (due to its depth below planned navigation uses), and because the contamination levels are relatively low in the additional materials removed under Alternative 7. Residual sediments would remain under Alternative 7, as with Alternatives 5 and 6. Under Alternative 7, the deep dredging of the 1960s industrial channel requires integration of shoreline infrastructure improvements in order to ensure the stability of resulting shoreline side-slopes. The benefits of additional contaminant removal are also partially offset by the increased levels of short-term risk due to the additional dredging activity. Short-term risks are discussed further below.

Alternative 8 also receives a high ranking for overall protectiveness. Alternative 8 makes the most aggressive use of dredging and upland disposal. Other technologies are used only sparingly. However, the benefits of further reductions in residual sediment concentrations and volumes are offset by the

extensive increase in short-term risks associated with the construction of the remedy. This alternative would require between 5 and 7 in-water construction seasons to complete dredging. Because the additional subsurface sediments removed under Alternative 8 have the lowest constituent concentrations of all site materials, the incremental removal activities of this alternative result in no significant improvement in overall protectiveness over Alternatives 5 and 6. The use of institutional controls and containment is still required under this alternative.

Permanence

Alternatives 1, receives a low ranking for remedy permanence. Alternative 1 makes the least use of active remedial measures. Monitored natural recovery is used to address remaining contaminated areas within the Whatcom Waterway navigation areas, and the cleanup does not address local navigation and land use needs. The result is that residual contaminated sediments would remain in locations and at elevations where the potential for future contaminated sediment re-exposure is considered significant. Additionally, Alternative 1 conducts no volume reduction or consolidation. All sediments are managed in place under this alternative. Engineering controls applied under other alternatives are not applied in the Waterway navigation areas, resulting in lower levels of remedy permanence, and a greater potential for contaminant disturbance through prop wash or other anthropogenic disturbances.

Alternatives 2 and 3 are ranked medium for permanence. These technologies do not reduce receive high rankings for permanence because they do not reduce the toxicity or volume of sediments remaining on the waterfront, and because they do not make extensive use of high-preference remedial technologies as defined under MTCA. Alternatives 2 and 3 involve extensive dredging within the Whatcom Waterway, but these dredged materials are not removed from the waterfront. These materials are managed by containment on-site within either a Cornwall CAD facility or an ASB nearshore fill. The targeted dredging depth is well below the anticipated needs of navigation and land use. This should avoid the potential future re-exposure of contaminated sediments, provided that remedial activities are coordinated with the upgrades to shoreline infrastructure required to stabilize the project shorelines during and after dredging. Under these alternatives, the ASB sludges remain in place and are managed either by containment beneath a sediment cap, or by containment within the ASB nearshore fill. Aquatic reuse of the ASB is precluded under these alternatives as part of the engineering and institutional controls for containment of the ASB sludges.

Alternative 4 is ranked medium for permanence. Like Alternatives 2 and 3, Alternative 4 removes contaminated sediment from areas and depths of the Whatcom Waterway where conflicts with navigation and land use plans may potentially result in future re-exposure of contaminated sediments. However, unlike preceding alternatives, the dredged materials generated from this action

are managed by upland disposal in an off-site permitted Subtitle D facility. This reduces the overall quantity of contaminated sediments managed on-site, while avoiding the creation of a new disposal facility on the waterfront. The permanence ranking for this alternative is not as high as in Alternatives 5, 6, 7 and 8, because these other alternatives include removal of the ASB sludges, the materials with the highest residual contaminant concentrations compared to SMS cleanup levels.

Alternatives 5, 6 and 7 are each ranked medium for permanence. Permanence of these alternatives is significantly higher than for Alternatives 2, 3 and 4. However, they do not carry the removal of contaminated sediments to the logical extreme as in Alternative 8, which removes the most contaminated sediments and sludge from the waterfront of any of the evaluated alternatives. Therefore, the permanence of these alternatives is considered medium, in relation to Alternative 8. Each of these alternatives provides substantial reductions in the volume of impacted sediments and sludges remaining on the waterfront. Alternatives 5 and 6 complete the removal of the ASB sludges, the most heavily impacted materials remaining in the site cleanup areas. This removes conflicts between planned aquatic reuse of this area, and reduces the potential that contaminated sludges are re-exposed in the future. The sludges are managed using high-preference remedial technologies, with treatment to reduce volumes, and subsequent disposal in an off-site permitted Subtitle D facility. These alternatives also remove low-level sediments that are present in Waterway navigation areas to support the implementation of a multi-purpose waterway. This action removes contaminated sediments from the areas where re-exposure may occur due to conflicts with navigation and land-use planning. Alternative 7 removes additional quantities of these low-level waterway sediments from areas and depths beyond those required to accommodate planned navigation and land uses, aggressively dredging the Waterway based on the dimensions of the 1960s industrial navigation channel. Because these sediments additionally removed under Alternative 7 contain only low-level contamination, and because they are located at depths and locations unlikely to be re-exposed in the future, this additional removal does not substantially increase the permanence of the alternative over that in Alternatives 5 and 6.

Alternative 8 is ranked high for the parameter of permanence, because it makes the greatest use of dredging and upland disposal of any of the evaluated remedial alternatives. This additional volume reduction does not significantly enhance overall protectiveness relative to Alternatives 5, 6 or 7 because the additional removal is targeted at low-level contaminated sediments located in outlying site areas. The removal of this high-volume, low-concentration materials is not expected to affect residual surface sediment concentrations after completion of the remedy, and the removal is not required to prevent re-exposure of contaminated sediments due to navigation or land use conflicts. Further, the removal of these materials provides the least incremental benefit in terms of the mass of contaminant removal achieved, due to the low average concentration of contaminants in these materials. However, because

Alternative 8 makes the greatest use of high-preference removal technologies, it receives the highest ranking for remedy permanence.

Long-Term Effectiveness

Long-term effectiveness is a parameter that expresses the degree of certainty that the alternative will be successful in maintaining compliance with cleanup standards over the long-term performance of the remedy. The MTCA regulations contain a specific preference ranking for different types of technologies that is considered as part of the comparative analysis. The preference ranking places the highest preference on technologies such as reuse/recycling, treatment, immobilization/solidification, and disposal in an engineered, lined, and monitored facility. Lower preference rankings are applied for technologies such as on-site isolation/containment with attendant engineering controls, and institutional controls and monitoring. The regulations recognize that in most cases the cleanup alternatives will combine multiple technologies to accomplish remedial objectives. The preference ranking must be considered along with other site-specific factors in the ranking of long-term effectiveness.

The alternatives evaluated in this Feasibility Study were organized in Table 6-1 in order of increasing use of high-preference technologies and overall long-term effectiveness. Alternatives 1, 2 and 3 use only containment, monitored natural recovery and institutional controls to comply with cleanup objectives. Alternative 1 receives a low long-term effectiveness ranking (Table 7-2) because the alternative makes the least use of active remedial measures. The long-term effectiveness of this alternative is subject to additional verification through natural recovery modeling as part of Cleanup Action Plan development and project design and permitting.

Alternatives 2 and 3 also utilize only containment, monitored natural recovery and institutional controls to comply with cleanup objectives. However, long-term effectiveness of these Alternatives is ranked medium rather than low, because these alternatives consolidate some of the sediments in containment facilities, rather than using only in-place containment, and because contaminated materials are removed from areas of the Whatcom Waterway where such materials might be re-exposed due to land use and navigation conflicts under Alternative 1.

Alternative 4 introduces the use of disposal in a lined, engineered facility, a technology that receives a higher preference-ranking than containment under MTCA criteria. Like Alternatives 2 and 3, Alternative 4 removes contaminated sediments from areas of the Whatcom Waterway where these sediments may be re-exposed due to land use and navigation conflicts. The dredging pattern is integrated with land use planning efforts, and shoreline stabilization is performed as part of the cleanup, reducing the potential for contaminant re-exposure due to shoreline instability or due to conflicts with separate infrastructure projects. The long-term effectiveness ranking for

Altenrative 4 is medium rather than high, because removal and disposal technologies are not applied to the ASB sludges, the most-contaminated materials remaining. Land use conflicts in the ASB area are not addressed, resulting in a continued potential for re-exposure of the sludge materials in the future.

Alternatives 5, 6, 7 and 8 all earn high rankings for long-term effectiveness. Alternatives 5 and 6 conduct extensive use of upland disposal in a Subtitle D landfill facility. Removal and disposal is expanded to include the ASB sludges, the most contaminated materials remaining on the waterfront. In addition, treatment of ASB sludges is performed as part of the sludge removal under this Alternative. Finally, these alternatives enable clean berm materials from the ASB to be reused as part of cleanup activities. The use of these disposal, treatment and reuse technologies is carried forward in Alternatives 7 and 8, so these Alternatives also receive the high ranking for long-term effectiveness.

Short-Term Risk Management

Short-term risk management is a parameter that measures the relative magnitude and complexity of actions required to maintain protection of human health and the environment during implementation of the cleanup action. Cleanup actions carry risks associated with mobilization of contaminants and also safety risks typical to large construction projects. In-water dredging activities carry a relatively high risk of problems with water quality and potential sediment recontamination. In some situations the short-term risks of a dredging action can offset the long-term benefits of sediment removal. Other short-term risks associated with construction activities must be controlled through the use of best practices during project design and construction.

The lowest rankings for short-term risk management are earned by Alternative 8. While this alternative has the highest permanence rankings, the same actions that produce this high ranking for permanence trigger short-term risks that must be managed during project implementation. Specifically, this alternative makes the greatest use of dredging technology, which carries with it a significant risk of water quality and recontamination impacts. Alternative 8 is estimated to require between 5 and 7 construction seasons to complete in-water dredging. This alternative also involves deep dredging within the Inner Whatcom Waterway which must be integrated with shoreline infrastructure upgrades in order to maintain stability of project area shorelines.

Medium rankings are applied to Alternatives 2, 3 and 7. These alternatives include between two and four construction seasons for in-water dredging and construction. Alternative 2 involves the creation of a new in-water disposal site near the Cornwall Avenue landfill that adds complexity to this Alternative and that will likely extend the overall construction duration to 4 seasons. All three alternatives require the integration of deep dredging within the Inner

Whatcom Waterway with shoreline infrastructure upgrades in order to maintain stability of adjacent shorelines.

High rankings for short-term risk management are applied to Alternatives 1, 4, 5 and 6. Alternatives 1 and 4 involve the least in-water construction activities. The capping and dredging associated with these alternatives is expected to be completed within a single construction season. Note however that the high short-term risk-management ranking for Alternative 1 is offset by low long-term effectiveness, permanence and overall protectiveness rankings for the same Alternative. Alternatives 5 and 6 are expected to involve two construction seasons for in-water dredging activities. Most ASB remediation activities under these Alternatives will take place prior to opening of the ASB berm, reducing the potential for water quality or recontamination impacts for this portion of the project.

Implementability

Implementability is an overall measurement expressing the relative difficulty and uncertainty of implementing the project. It includes technical factors such as the availability of mature technologies and experienced contractors to accomplish the cleanup work. It also includes administrative factors associated with permitting, funding and completing the cleanup. All of the alternatives are complex and require significant actions during design, permitting and construction to achieve a successful project. Yet all alternatives are sufficiently implementable to pass the threshold criteria under MTCA. The following rankings express the relative implementation challenges associated with each of the evaluated alternatives.

The lowest scores for implementability apply to Alternative 1 and to Alternative 8. The *technical* implementability of Alternative 1 is high, because it has the least construction activities of any of the Alternatives. However, the lack of active remedial measures for cleanup in the Whatcom Waterway and the conflicts between the alternative and planned land use, navigation and habitat restoration activities in the Whatcom Waterway result in a low *administrative* implementability. The low implementability ranking for Alternative 8 is associated with the logistical complexity of the project, and the conflicts between the dredging plan with planned land uses.

Medium implementability rankings apply to Alternatives 2, 3 and 7. These alternatives are technically implementable, but the reliance of these alternatives on dredging of the obsolete 1960s federal channel is inconsistent with current zoning and land use planning for the waterfront area. The alternatives would require substantial investments in new shoreline infrastructure that conflict with current planning for land use, navigation and habitat enhancement. The land use and navigation restrictions associated with maintenance of the federal channel to the head of the Inner Whatcom Waterway conflict with the need for a multi-purpose waterway. As with Alternative 8, the implementation of one of these three alternatives would

require a reversal in land use and navigation planning, inconsistent with current requirements and community priorities. Finally, Alternatives 2 and 3 conflict with planned aquatic uses and landowner objectives for the ASB.

Alternative 4 receives a medium score for implementability. The construction activities associated with Alternative 4 are less complex than those of most of the other alternatives, and the dredging approach to the Waterway is consistent with the concept of the locally-managed multi-purpose channel. However, the alternative does not enable future aquatic use of the ASB area. This would likely lead to conflicts between the alternative and land use planning and land owner objectives for the ASB.

High implementability rankings are applied to Alternatives 5 and 6. Like the other alternatives, these actions will involve complex construction activities and will require the development of appropriate permits and institutional controls. However, the construction methods used all rely on available technologies for which experienced contractors are available within the region. The administrative implementability of these alternatives is high, because these alternatives directly address the identified community land use, navigation and habitat priorities, both in the Waterway area and also in the ASB area. The strong net gain in habitat benefits associated with these alternatives also improves the permitting implementability of Alternatives 5 and 6 relative to other project alternatives.

Consideration of Public Concerns

Public review of this RI/FS and of the companion EIS document will be used to solicit public concerns regarding the remedial alternatives and to inform Ecology's cleanup decision for the Site.

However, the analysis of remedial alternatives presented in this Feasibility Study builds on nearly 10 years of community involvement in the investigation, cleanup and redevelopment of the Bellingham Waterfront. That community involvement has taken place in a number of different forums, including but not limited to the following:

- Site-specific community involvement activities for the Whatcom Waterway site
- Community involvement efforts associated with the Bellingham Bay Demonstration Pilot
- Early land use priority setting conducted by the Waterfront Futures Group, and subsequent formal adoption of the Waterfront Futures Group land use principles by the City of Bellingham
- Land use studies conducted for the Central Waterfront area

- Master Planning efforts for the Bellingham Shipping terminal and vicinity

- Alternatives evaluations for siting of new marina facilities to meet regional moorage demand, and Port marina and waterfront infrastructure planning including community-based design charette activities

- Outreach activities conducted by the Port of Bellingham as part of the GP due diligence process during 2004 and 2005, including soliciting of extensive stakeholder and public input on potential waterfront cleanup actions, land use alternatives and navigation priorities for the Whatcom Waterway

- Community land use planning efforts planning and redevelopment of the New Whatcom area leading to rezoning of the area for mixed-use development

- Outreach activities associated with the Port's amendment to its Comprehensive Scheme of Harbor Improvements identifying the need for future aquatic use of the ASB area and associated with updates to the federal navigation channel in the Whatcom Waterway

- Extensive additional contributions by community groups, research institutions, and project stakeholders

The composite rankings listed in Table 7-2 represent an attempt to summarize the potential for each alternative to address public concerns and interests that have been raised in past public involvement activities. Given the range of opinions previously offered, including conflicting opinions from different groups, no one alternative can be 100% compliant with all community input. The rankings provided in Table 7-2 are intended to reflect on balance, how well the alternatives address the cross-section of comments received to date.

Alternative 1 receives a low ranking in reflection of three key factors. First, the alternative makes the least use of active measures to implement site cleanup, and provides the least overall protectiveness of the evaluated alternatives. Second, it is not clear that Alternative 1 would provide for planned navigation uses in and adjacent to the Waterway. Third, the alternative does not provide sufficiently for future aquatic uses of the ASB, in direct conflict with area land use planning and landowner objectives.

Alternative 2 receives a medium ranking under this criterion. The use of the Cornwall CAD site under Alternative 2 to optimize the management of dredged materials received generally favorable response during the 2000 EIS process. Based on this response, the CAD site location and design concept

appears to address community concerns. State-owned land issues associated with the disposal site location would need to be addressed as part of the institutional controls for the project, and project design and permitting would need to address disposal site monitoring and other considerations. Alternative 2 receives a medium ranking because 1) it relies on dredging of the obsolete 1960s federal channel dimensions which are inconsistent with area zoning, land use actions and navigation priorities, and 2) the alternative does not provide for future aquatic uses of the ASB, in direct conflict with area land use planning. The positive habitat benefits associated with the CAD site development likely make alternative more responsive to public concerns than Alternative 3.

Alternative 3 receives a low ranking for responsiveness to public concerns. The use of the ASB site under Alternative 3 for a sediment nearshore fill received mixed comment during public comment on the 2002 Supplemental Feasibility Study (Anchor 2002). The proposal was favored by some commenters because the ASB reduced the level of in-water construction activities otherwise required at the Cornwall CAD site. The alternative also moved the location of the disposal site off of state-owned aquatic lands. However, other commenters expressed concern over the creation of a new fill site on the Bay, and expressed a desire for alternatives that removed impacted materials including the ASB sludges from the waterfront. The Port and City commented that the ASB fill proposal was inconsistent with the Shoreline Master Program and did not address future land uses for the filled areas or vicinity. In addition, area land use planning efforts identified as a priority the integrated use of the ASB for public access, habitat enhancement and marina navigation uses. As with Alternative 2, there are additional concerns related to the waterway dredging patterns proposed under Alternative 3. Specifically, the 1960s federal channel boundaries, shoreline use restrictions and infrastructure requirements are not consistent with the current mixed-use zoning, or with the land use and habitat enhancement priorities identified for the Inner Whatcom Waterway areas. These critical issues are considered to be better addressed in other alternatives evaluated in the Feasibility Study (i.e., Alternatives 4, 5 and 6).

Alternative 4 receives a medium ranking for responsiveness to public concerns. The use of the locally-managed multi-purpose Waterway concept under Alternative 4 is more consistent with the waterfront land use, navigation and habitat enhancement planning for the Inner Whatcom Waterway. However, the Alternative does not provide for future multi-purpose uses of the ASB. The ASB was identified as the preferred location for a future marina, integrating navigation, public access and habitat enhancement uses. The continued presence of the highly-impacted ASB sludges would prevent development of these uses or alternative aquatic uses. Alternative 4 uses upland disposal for management of dredged sediments, consistent with many of the comments received in previous site evaluations. However, the proportion of sediments managed by upland disposal is less than in other

evaluated alternatives, and the most-impacted materials (the ASB sludges) are managed by containment-in-place.

Alternative 5 is highly responsive to community concerns that have been raised during previous cleanup and land use planning efforts and receives a high ranking. The Alternative makes extensive use of removal, treatment and upland disposal technologies for management of contaminated sludges and sediments. The locally-managed multi-purpose Waterway concept supported under Alternative 5 is consistent with the land use vision of the Waterfront Futures Group and the local land use planning process. The Alternative also provides for aquatic uses of the ASB. These uses include the development of an environmentally-sustainable marina, development of extensive shoreline public access areas, and development of new habitat enhancement features. Alternative 5 also preserves the flexibility for continued deep draft uses at the Bellingham Shipping terminal. Some commenters will likely state a desire for additional removal and upland disposal of contaminated sediments, beyond that conducted in Alternative 5.

As with Alternative 5, Alternative 6 is highly responsive to public concerns that have been raised during previous cleanup and land use planning efforts, and receives a high ranking. Extensive public comment and input from regulatory agencies and project stakeholders was used to shape this alternative during the Port's due diligence process in 2004, prior to purchase of the GP properties. The Alternative makes extensive use of removal, treatment and upland disposal technologies for management of contaminated sludges and sediments. The locally-managed multi-purpose Waterway concept supported under Alternative 6 is consistent with waterfront land use priorities. The Alternative also provides for aquatic uses of the ASB. The main incremental benefit of Alternative 6 (compared to Alternative 5) is that it removes impacted sediments to the maximum extent technically feasible within Unit 1-C, and reduces the need for capping in the portion of the Outer Whatcom Waterway adjacent to the Bellingham Shipping Terminal. As with Alternative 5, some commenters will likely state a desire for additional removal and upland disposal of contaminated sediments, beyond that conducted in Alternative 6.

Alternative 7 receives a medium ranking for consideration of public concerns. The alternative conducts a greater degree of dredging and upland disposal than does Alternative 5 or Alternative 6. Alternative 7 will likely be favored by commenters seeking a greater quantity of upland disposal for the Whatcom Waterway area. Secondly, Alternative 7 supports aquatic reuse of the ASB, consistent with local land use planning. However, the alternative will likely receive unfavorable comments relating to 1) the destruction of habitat at the head and along the sides of the Inner Whatcom Waterway, 2) concerns about the conflicts between the shoreline infrastructure requirements of this alternative and the planned land uses, navigation patterns and habitat enhancement objectives in the Inner Whatcom Waterway, 3) concerns about

the high costs of the alternative. Based on these considerations, a medium ranking is included in Table 7-2 for Alternative 7.

Alternative 8 is ranked low in Table 7-2 for consideration of public concerns. Alternative 8 is likely to receive favorable comment from commenters who desire the site cleanup to maximize the use of dredging and upland disposal and minimize the use of other technologies, and who are not concerned about costs, land use impacts, short-term environmental affects or habitat impacts of the alternative. However, a variant of Alternative 8 was evaluated previously during the 2000 RI/FS and EIS process. That previous alternative was determined to be inappropriate for application, even under an industrial land use scenario. The alternative was determined by Ecology to have substantial and disproportionate costs, and did not provide the level of habitat benefits provided under the 2000 EIS preferred alternative. The dredging activity under Alternative 8 creates short-term risks and habitat disruptions that offset benefits associated with additional sediment removal. The change in area land use and the desire to incorporate public access and habitat enhancements into the Inner Whatcom Waterway create direct conflicts between the area land use priorities and Alternative 8. Alternatives 5 and 6 achieve a much higher degree of integration with area land use and habitat enhancement priorities.

7.3.2 MTCA Disproportionate Cost Analysis

Consistent with MTCA requirements for remedy selection, the costs and benefits associated with the evaluated remedial alternatives are compared using a disproportionate cost analysis. The disproportionate cost analysis compares the relative environmental benefits of each alternative against those provided by the most permanent alternative evaluated. Costs are disproportionate to benefits if the incremental costs of the more permanent alternative exceed the incremental degree of benefits achieved by the other lower-cost alternative (WAC 173-340-360(e)(i)). Alternatives which exhibit such disproportionate costs are considered “impracticable”. Where the quantitative and qualitative benefits of two alternatives are equivalent, MTCA specifies that Ecology shall select the less costly alternative (WAC 173-340-360(e)(ii)(c)).

Relationship Between Remedy Costs and Benefits

Table 7-2 summarizes for each alternative the remedy cost, as well as the remedy benefits discussed in Section 7.3.1. Appendices A and B contain a detailed cost break down for each alternative. Costs are presented based on the probable remedy costs from Figure 6-9. Detailed cost assumptions are documented in Appendices A and B of this Feasibility Study. Excluding project contingencies, the probable costs of the Alternatives range from a low value of $8 million to a high value of $146 million. These costs are expressed in 2005 dollars without adjustments for future cost inflation and without present value discounting of future costs. Actual project costs are expected to

vary within a range of +/- 30% around these probable estimates, as shown in Figure 6-9.

Table 7-2 summarizes the overall benefits associated with each alternative using a composite benefit ranking. The composite ranking is shown in Section 3 of Table 7-2. The composite ranking integrates the rankings for individual evaluation criteria discussed in Section 7.3.1. The composite ranking is expressed as an average (i.e., a remedy with three low benefits rankings and three high benefits rankings is considered on average to provide a medium level of overall benefit in the composite ranking).

Consistent with MTCA requirements, the relative benefits and costs of each alternative are compared to Alternative 8. Alternative 8 makes the greatest use of high-preference remedial technologies, and represents the most permanent remedial alternative evaluated in the Feasibility Study. It therefore provides the benchmark against which the relationship between incremental remedy benefits and incremental costs are evaluated.

Alternative 8 receives an overall benefit ranking of medium. Because the alternative uses the greatest degree of dredging and upland disposal, the remedy is considered to provide high benefit rankings under overall protectiveness, permanence and long-term effectiveness. However, the alternative has low rankings for short-term risk management, implementability and consideration of public concerns. The composite ranking of medium is the same or slightly lower than that for Alternative 7, though Alternative 8 is almost twice the cost of Alternative 7. Because the costs of Alternative 8 are substantially higher than those of Alternative 7, whereas the level of benefits is the same or lower, the incremental costs of Alternative 8 are considered disproportionate.

Alternative 7 likewise receives a composite benefit ranking of medium. The alternative has high rankings for overall protectiveness and long-term effectiveness, but medium rankings for permanence, short-term risk management, implementability and consideration of public concerns. The costs of Alternative 7 are approximately $30 million greater than those of Alternative 6, though the level of benefits achieved is slightly lower than those of Alternative 6. Because the costs of Alternative 7 are substantially higher than those of Alternative 6, whereas the level of benefits is the same or lower, the incremental costs of Alternative 7 are considered disproportionate.

The composite rankings of Alternatives 5 and 6 are both high. The alternatives are ranked high for overall protectiveness, long-term effectiveness, short-term risk management, implementability and consideration of public concerns. The alternatives have medium rankings for permanence relative to Alternative 8, because they do not carry the use of dredging and disposal to the logical extreme as in Alternative 8. Costs of Alternatives 5 and 6 are $42 million and $44 million respectively. These costs are significantly higher than the next

group of alternatives (Alternatives 2, 3 and 4). However, Alternatives 5 and 6 provide a higher level of benefits as measured against MTCA criteria. Therefore, the incremental costs of Alternatives 5 and 6 are not considered disproportionate.

Figure 7-1 provides graphical illustrations of the relationship between remedy costs and benefits for each of the alternatives. Remedy benefits are plotted in red using the composite rankings from Table 7-2. Probable costs from Figure 6-9 are plotted on the figure along with the other information. The substantial increase in costs between Alternatives 5 and 6 and those of Alternative 7 and 8 is readily apparent from the graph of remedy costs. Because the increases in costs are not accompanied by a corresponding increase in remedy benefits, MTCA specifies that these alternatives are impracticable, and that the lower cost alternatives should be selected. Whereas, the incremental costs associated with Alternatives 5 and 6, while higher than those of Alternatives 2-4, are accompanied by an increase in remedy benefits. Because the incremental costs of these alternatives are proportionate to increases in remedy benefits, these incremental costs are not considered disproportionate. Alternatives 5 and 6 are not considered impracticable. Because Alternatives 5 and 6 have a greater degree of overall benefit than the remaining alternatives, these alternatives are considered "permanent to the maximum extent practicable" under MTCA.

An additional way of expressing the benefits of an environmental cleanup action is to measure the quantity of contamination removed by the action. *Assuming hypothetically that all other parameters are equal between two alternatives*, an alternative that removes a greater quantity of contamination from a site can be considered to provide greater benefits. For instance, if two different remedies each removed 1 cubic yard of sediment from the site, and all other factors were identical (cost, short-term risk management, etc.), the remedy that removed sediment containing a higher contaminant concentration would be considered to be more permanent and produce greater environmental risk reduction under MTCA.

Consistent with the above-described hypothetical example, Figure 7-1 expresses the relative concentration of the sediments that are managed using containment technologies rather than removal for each of the alternatives. The relative concentration is expressed using the cumulative enrichment ratio, a measurement of all of the contaminants measured in a sample relative to their sediment cleanup standards. The enrichment ratio is plotted for the most contaminated sediment volume removed by the subsequent alternatives. Alternatives 1, 2, and 3 all use containment technology to manage contaminated sediments and ASB sludges. Therefore, the cumulative enrichment ratio remains high for each of these alternatives. Actual benefits increase from low in Alternative 1 to medium in Alternative 2 and 3 due to the other actions taken in the alternatives. Likewise, Alternative 4 is environmentally protective, but does not remove the highest-concentration materials from the waterfront. Alternatives 5 and 6 both complete removal and

upland disposal of the ASB sludges, the most contaminated remaining materials. Containment technologies are used only for sediments containing lower contaminant levels. The increase in remedy costs results in a corresponding reduction in the contaminant concentrations as shown on Figure 7-1. In contrast, the incremental sediment removals performed in Alternatives 7 and 8 produce only modest further decreases in the concentration of sediments managed by containment. Most of the incremental sediment removal is directed at low-level sediment contamination located in deep-water and outlying site areas. The removal of these sediments requires a high dredging volume and corresponding high costs, but produces little additional environmental benefit.

Conclusions of Disproportionate Cost Analysis

The conclusions of the disproportionate cost analysis are summarized in the top row of Table 7-2. This analysis is central to the MTCA selection of a preferred alternative.

Alternative 1 receives a low overall preference ranking, because of its low overall protectiveness, low permanence, its poor implementability, and its poor responsiveness to community concerns. It is a low-cost alternative, but it is not sufficiently permanent as defined under MTCA to be selected as a preferred alternative. Alternative 1 is not permanent to the maximum extent practicable.

Alternatives 2, 3 and 4 receive medium overall preference rankings. These alternatives provide improved overall protectiveness and long-term effectiveness relative to Alternative 1. However, these alternatives do not provide the degree of permanence achieved by other practicable alternatives making a greater use of higher-preference technologies under MTCA. These alternatives also do not address the community concerns regarding future land use as discussed in the EIS. Alternatives 2, 3 and 4 are not considered permanent to the maximum extent practicable, and are not considered preferred alternatives under MTCA.

Alternatives 5 and 6 are identified as preferred alternatives, based on the MTCA analysis of disproportionate costs. These alternatives make the greatest use of high-preference technologies and provide the greatest remedy permanence and long-term effectiveness while remaining practicable. The high-cost dredging and removal actions performed under these alternatives are appropriately targeted at the materials that 1) have the highest constituent levels, 2) that conflict with land use and navigation needs and are likely to be disturbed in the future, 3) that can be removed safely without an excessive level of short-term risk, and 4) that consider community concerns raised during previous public involvement activities. Alternatives 5 and 6 are permanent to the maximum extent practicable under MTCA, and are identified as the preferred alternatives.

Alternatives 7 and 8 both receive low rankings, because these alternatives are impracticable. The additional removal activities conducted in Alternatives 7 and 8 expand the use of high-preference technologies, but apply these additional efforts only to subsurface sediments with low contaminant levels that are safely managed using other technologies in the preceding alternatives. As shown in Figure 7-1 the incremental costs of these alternatives are substantial and disproportionate relative to the additional degree of contaminant removal achieved and to the incremental remedy benefits achieved. Based on the environmental protections present in the other alternatives, there is no significant reduction in residual risk in Alternatives 7 and 8, despite a doubling or tripling of cleanup costs. Alternatives 7 and 8 are therefore not identified as preferred remedial alternatives, but rather are considered impracticable.

Table 7-1. Detailed MTCA Evaluation of Alternatives

Alternative Number	**Alt. 1**	**Alt. 2**	**Alt. 3**	**Alt. 4**	**Alt. 5**	**Alt. 6**	**Alt. 7**	**Alt. 8**
Probable Cost ($Million)	$8	$34	$34	$21	$42	$44	$74	$146
Design Concept	Figure 6-1	Figure 6-2	Figure 6-3	Figure 6-4	Figure 6-5	Figure 6-6	Figure 6-7	Figure 6-8
Alternative Description								
Waterway Remedy								
Waterway Uses	Limited-Use: Water depths are restricted throughout the Inner and Outer Waterway. Shorelines are not stabilized as part of project.	Industrial: Whatcom Waterway is dredged consistent with dimensions of 1960s industrial channel. Uses conflict with local land use and navigation planning.	Industrial: Whatcom Waterway is dredged consistent with dimensions of 1960s industrial channel. Uses conflict with local land use and navigation planning.	Multi-Purpose: Remedy provides for continued deep draft uses in Outer Waterway. Inner Waterway is managed as multi-purpose channel consistent with planned mixed-Use redevelopment, including infrastructure and navigation planning.	Multi-Purpose: Remedy provides for continued deep draft uses in Outer Waterway. Inner Waterway is managed as multi-purpose channel consistent with planned mixed-Use redevelopment, including infrastructure and navigation planning	Multi-Purpose: Remedy provides for continued deep draft uses in Outer Waterway. Inner Waterway is managed as multi-purpose channel consistent with planned mixed-Use redevelopment, including infrastructure and navigation planning.	Industrial: Whatcom Waterway is dredged consistent with dimensions of 1960s industrial channel. Uses conflict with local land use and navigation planning.	Industrial: Whatcom Waterway is dredged consistent with dimensions of 1960s industrial channel. Uses conflict with local land use and navigation planning.
Sediment Disposal	None -- All impacted sediments are managed in place through capping and natural recovery.	Cornwall CAD: Sediments dredged from Whatcom Waterway are consolidated within a containment area constructed near Cornwall Avenue Landfill.	ASB Fill: Aquatic sediments dredged and consideated along with the ASB sludges within the ASB nearshore fill.	Upland: Sediments dredged will be disposed and managed by upland disposal in a permitted off-site Subtitle D facility.	Upland: Sediments dredged will be disposed and managed by upland disposal in a permitted off-site Subtitle D facility.	Upland: Sediments dredged will be disposed and managed by upland disposal in a permitted off-site Subtitle D facility.	Upland: Sediments dredged will be disposed and managed by upland disposal in a permitted off-site Subtitle D facility.	Upland: Sediments dredged will be disposed and managed by upland disposal in a permitted off-site Subtitle D facility.
ASB Remedy								
Future Uses	Non-Aquatic: Capping of ASB sludges. Area remains isolated from Bellingham Bay.	Non-Aquatic: Capping of ASB sludges. Area remains isolated from Bellingham Bay.	Non-Aquatic: Nearshore Fill is Constructed within ASB, Converting Area Permanently to Upland Characteristics	Non-Aquatic: Capping of ASB sludges. Area remains isolated from Bellingham Bay.	Aquatic Uses: ASB Sludges are Removed and Berm is Opened, Restoring Connection of ASB Basin with Bellingham Bay	Aquatic Uses: ASB Sludges are Removed and Berm is Opened, Restoring Connection of ASB Basin with Bellingham Bay	Aquatic Uses: ASB Sludges are Removed and Berm is Opened, Restoring Connection of ASB Basin with Bellingham Bay	Aquatic Uses: ASB Sludges are Removed and Berm is Opened, Restoring Connection of ASB Basin with Bellingham Bay
Sludge Disposal	None: No removal of the ASB sludges will be conducted.	None: No removal of the ASB sludges will be conducted.	None: No removal of the ASB sludges will be conducted.	None: ASB sludges are managed in place through capping.	Upland: ASB sludges are removed, dewatered and managed by upland disposal in a permitted off-site Subtitle D facility.	Upland: ASB sludges are removed, dewatered and managed by upland disposal in a permitted off-site Subtitle D facility.	Upland: ASB sludges are removed, dewatered and managed by upland disposal in a permitted off-site Subtitle D facility.	Upland: ASB sludges are removed, dewatered and managed by upland disposal in a permitted off-site Subtitle D facility.
Basis for Alternative Ranking Under MTCA & SMS								
1 Compliance with MTCA Threshold Criteria[1] *(WAC 173-340-360(2)(a))*								
Protection of Human Health & Environment	Yes -- Protectiveness of Alternative 1 is contingent on ability to demonstrate compliance with cleanup standards, which requires additional modeling in remedial design.	Yes -- Alternative will protect human health and the environment.	Yes -- Alternative will protect human health and the environment.	Yes -- Alternative will protect human health and the environment.	Yes -- Alternative will protect human health and the environment.	Yes -- Alternative will protect human health and the environment.	Yes -- Alternative will protect human health and the environment.	Yes -- Alternative will protect human health and the environment.
Compliance with Cleanup Standards	Yes -- However, Alternative 1 is the only alternative that relies on natural recovery for cleanup of site areas that do not already compliy with cleanup goals. Requires additional modeling as part of remedial design to verify effectiveness.	Yes -- Alternative 2 is expected to comply with cleanup standards. Additional modeling in remedial design will be required for the CAD site to verify compliance with surface water criteria for groundwater discharging through fill material.	Yes -- Alternative 3 is expected to comply with cleanup standards. Additional modeling in remedial design will be required for the ASB fill site to verify compliance with surface water criteria for groundwater discharging through fill material.	Yes -- Alternative is expected to comply with cleanup standards. Active remedial measures are used in all site areas not currently complying with cleanup levels.	Yes -- Alternative is expected to comply with cleanup standards. Active remedial measures are used in all site areas not currently complying with cleanup levels.	Yes -- Alternative is expected to comply with cleanup standards. Active remedial measures are used in all site areas not currently complying with cleanup levels.	Yes -- Alternative is expected to comply with cleanup standards. Active remedial measures are used in all site areas not currently complying with cleanup levels.	Yes -- Alternative is expected to comply with cleanup standards. Active remedial measures are used in all site areas not currently complying with cleanup levels.
Compliance with Applicable State & Federal Laws	Yes -- However, Alternative 1 will affect navigation and land use planning for Whatcom Waterway, and will prevent future aquatic reuse of the ASB. Requires accomodations to be made as part of ongoing local land use planning efforts.	Yes -- However, this alternative requires the development of a new sediment disposal site which may be inconsisent with the current Shoreline Master Program. This alternative also restricts future aquatic reuse of the ASB, conflicting with local land use planning efforts. Addtionally, local planning activities will need to address the funding and construction of shoreline infrastructure and restrictions.	Yes -- However, this alternative requires the development of a new sediment disposal site which may be inconsisent with the current Shoreline Master Program. This alternative also restricts future aquatic reuse of the ASB, conflicting with local land use planning efforts. Addtionally, local planning activities will need to address the funding and construction of shoreline infrastructure and restrictions.	Yes -- Alternative complies with applicable laws and is consistent with local land use planning efforts for the Waterway. However, Alternative 4 restricts future aquatic reuse of the ASB, conflicting with local land use planning efforts.	Yes -- Alternative complies with applicable laws and is consistent with local land use planning efforts for the Waterway, ASB and Central Waterfront areas.	Yes -- Alternative complies with applicable laws and is consistent with local land use planning efforts for the Waterway, ASB and Central Waterfront areas.	Yes -- Alternative complies with applicable laws. However, local planning activities will need to address the funding and construction of shoreline infrastructure and restrictions on shoreline land uses for the Inner Waterway in order to support this alternative.	Yes -- Alternative complies with applicable laws. However, local planning activities will need to address the funding and construction of shoreline infrastructure and restrictions on shoreline land uses for the Inner Waterway in order to support this alternative.
Provision for Compliance Monitoring	Yes -- Alternative includes provisions for compliance monitoring.	Yes -- Alternative includes provisions for compliance monitoring.	Yes -- Alternative includes provisions for compliance monitoring.	Yes -- Alternative includes provisions for compliance monitoring.	Yes -- Alternative includes provisions for compliance monitoring.	Yes -- Alternative includes provisions for compliance monitoring.	Yes -- Alternative includes provisions for compliance monitoring.	Yes -- Alternative includes provisions for compliance monitoring.
2 Restoration Time-Frame *(WAC 173-340-360(2)(b)(ii))*	Restoration time-frame is relatively long, at 6 to 12 years. Time-frame is contingent on performance of natural recovery in meeting cleanup levels in Inner Waterway.	Restoration time-frame is 6 to 9 years required for design and construction. Shoreline infrastructure must be upgraded in Inner Waterway in parallel with cleanup.	Medium -- Restoration time-frame is 5 to 8 years required for design and construction. Shoreline infrastructure must be upgraded in Inner Waterway in parallel with cleanup.	Restoration time-frame is 3 to 4 years required for design and construction.	Restoration time-frame is 5 to 6 years required for design and construction.	Restoration time-frame is with 5 to 6 years required for design and construction.	Restoration time-frame is 5 to 8 years for design and construction. Shoreline infrastructure must be upgraded in Inner Waterway in parallel with cleanup.	Restoration time-frame is 8 to 13 years for design and construction. Shoreline infrastructure must be upgraded in Inner Waterway in parallel with cleanup.

Table 7-1. Detailed MTCA Evaluation of Alternatives

Alternative Number	**Alt. 1**	**Alt. 2**	**Alt. 3**	**Alt. 4**	**Alt. 5**	**Alt. 6**	**Alt. 7**	**Alt. 8**
Probable Cost ($Million)	$8	$34	$34	$21	$42	$44	$74	$146
Design Concept	Figure 6-1	Figure 6-2	Figure 6-3	Figure 6-4	Figure 6-5	Figure 6-6	Figure 6-7	Figure 6-8
Basis for Alternative Ranking Under MTCA & SMS (Cont'd)								
3 Evaluation of Permanence Using MTCA Disproportionate Cost Analysis *(WAC 173-340-360(2)(b)(i) & WAC 173-340-360(3)(f))*								
Overall Protectiveness	Protectiveness relies solely on the use of containment and natural recovery. Incremental protections present in other alternatives are not used.	Remedy uses active measures to address Waterway. However, Alternative requires creation of a new disposal site on waterfront. Alternative requires extensive shoreline infrastructure improvements to prevent shoreline instability in Inner Waterway.	Remedy uses active measures to address Waterway. However, Alternative requires creation of a new disposal site on waterfront. Alternative requires extensive shoreline infrastructure improvements to prevent shoreline instability in Inner Waterway.	Remedy uses active measures to address Waterway and uses upland disposal. However, extent of risk reduction achieved through upland disposal is not as great as in other alternatives.	Protectiveness of alternative is enhanced by the removal of ASB sludges from the waterfront. Establishment of consistent waterway depths and stable side-slopes reduces risk of recontamination and/or shoreline erosion.	Protectiveness of alternative is high, including removal of ASB sludges from the waterfront. Establishment of consistent waterway depths and stable side-slopes reduces risk of recontamination and/or shoreline erosion.	Alternative makes extensive uses of active remediation and off-site disposal. Alternative requires extensive shoreline infrastructure improvements to prevent shoreline instability in Inner Waterway.	Alternative makes greatest use of active remediation and off-site disposal. Alternative requires extensive shoreline infrastructure improvements to prevent shoreline instability in Inner Waterway.
Permanence	Remedy does not remove impacted sediments or sludges from the waterfront, and does not provide for consolidation of impacted materials.	Sediments are dredged from Waterway navigation areas. Remedy does not remove impacted sediments or sludges from the waterfront. Materials are managed by capping of ASB and partial sediment consolidation within Cornwall CAD site.	Sediments are dredged from Waterway navigation areas. Remedy does not remove impacted sediments or sludges from the waterfront. Materials are managed by consolidation within the new ASB nearshore fill.	Sediments are dredged from Waterway navigation areas. Remedy provides for some reduction in remaining sediment volumes in the Whatcom Waterway. ASB sludges are not removed from the waterfront.	Remedy provides substantial reductions in the volume of impacted sediments and sludges remaining on the waterfront. Provides for complete removal of ASB sludges. Removes impacted sediments in navigation areas of the waterway, consistent with needs of multi-purpose channel concept.	Remedy provides substantial reductions in the volume of impacted sediments and sludges remaining on the waterfront. Provides for complete removal of ASB sludges. Removes impacted sediments in navigation areas of the waterway, consistent with needs of multi-purpose channel concept.	Remedy removes ASB sludges from the waterfront. Extent of sediment removal in waterway is increased beyond that required for multi-purpose channel.	Remedy provides the greatest reduction in the volume of impacted subsurface sediments remaining on the waterfront.
Remedy Costs	$8 Million	$34 Million	$34 Million	$21 Million	$42 Million	$44 Million	$74 Million	$146 Million
Long-Term Effectiveness	Alternative 1 makes the least use of active remedial measures. Long-term effectiveness is subject to verification during remedial design.	Alternative uses only containment and institutional controls. Some increase in effectiveness achieved through sediment consolidation within the Cornwall CAD.	Alternative uses only containment and institutional controls. Some increase in effectiveness achieved through sediment consolidation within the ASB Nearshore Fill.	Application of upland disposal is limited to waterway sediments only. Most contaminated materials (ASB sludges) remain present on the waterfront.	Alternative makes extensive use of upland disposal. Dewatering treatment performed on ASB sludges. Alternative enables reuse of clean ASB berm materials.	Alternative makes extensive use of upland disposal. Dewatering treatment performed on ASB sludges. Alternative enables reuse of clean ASB berm materials.	Alternative makes extensive use of upland disposal, treatment and reuse.	Alternative makes extensive use of upland disposal, treatment and reuse.
Short-Term Risk Management	Alternative 1 involves the least in-water construction activities, with lowest anticipated short-term risks to safety and water quality.	Alternative requires four in-water construction seasons. New in-water disposal site construction adds complexity relative to other Alternatives. Deep dredging within Inner Waterway will destabilize shorelines and must be coordinated with upgrades in shoreline infrastructure.	Alternative requires two or three in-water construction seasons. Use of ASB as disposal site reduces short-term risks slightly over Alternative 2. Deep dredging within Inner Waterway will destabilize shorelines and must be coordinated with upgrades in shoreline infrastructure.	Alternative 4 involves second least in-water construction activities. Waterway construction likely to be completed within single construction season. Low anticipated short-term risks to safety and water quality.	Work in Waterway and harbor areas to be completed within two construction seasons. Most ASB remediation activities to take place prior to opening of ASB berm, reducing short-term risks to water quality.	Work in Waterway and harbor areas to be completed within two construction seasons. Most ASB remediation activities to take place prior to opening of ASB berm, reducing short-term risks to water quality.	Alternative requires three to four in-water construction seasons. Extensive off-site transportation of sediments and sludges required. Deep dredging within Inner Waterway will destabilize shorelines and must be coordinated with upgrades in shoreline infrastructure.	Alternative involves between 5 and 7 construction seasons to complete in-water dredging and off-site sediment transport. Highest degree of water quality and safety risks of evaluated Alternatives. Deep dredging within Inner Waterway will destabilize shorelines and must be coordinated with upgrades in shoreline infrastructure.
Implementability	Technical implementability of alternative is high. However, Alternative 1 has low administrative implementability due to conflicts with local land use and navigation planning.	Alternative is technically implementable. However, capping of ASB and dredging plan for Inner Waterway conflict with local land use and navigation priorties. Requires extensive upgrades in waterfront infrastructure that must be coordinated with Waterway dredging.	Alternative is technically implementable. However, filling of ASB and dredging plan for Inner Waterway conflict with plans for aquatic reuse of this area. Requires extensive upgrades in waterfront infrastructure that must be coordinated with Waterway dredging.	Construction activities are less complex than most other alternatives, resulting in high technical implementability. Waterway dredging approach is consistent with local land use and navigation priorities. However, capping restricts future aquatic reuse of the ASB, in conflict with local priorities.	Construction activities are complex, but use only established technologies. Administrative implementability is high due to consistency with planned land and navigation uses. Alternative produces strong net gain in habitat benefits, enhancing permittability of alternative.	Construction activities are complex, but use only established technologies. Administrative implementability is high due to consistency with planned land and navigation uses. Alternative produces strong net gain in habitat benefits, enhancing permittability of alternative.	Alternative has greater complexity and short-term risks than Alternatives 5 and 6. Dredging plan for Inner Waterway conflicts with local land use and navigation planning. Requires extensive upgrades in waterfront infrastructure, that must be coordinated with Waterway dredging.	Alternative has greaterest complexity and short-term risks. Dredging plan for Inner Waterway conflicts with local land use and navigation planning. Requires extensive upgrades in waterfront infrastructure, that must be coordinated with Waterway dredging.
Consideration of Public Concerns	Alternative 1 conflicts with planned land use and navigation in the Whatcom Waterway and in the ASB. Alternative relies solely on low-cost, low-preference technologies to comply with cleanup levels. Remedy has longer restoration time-frame and lower level of certainty due to use of natural recovery to comply with cleanup levels in navigation areas.	Potential DNR concerns about locating new CAD facility on state-owned aquatic lands. Alternative does not remove impacted sediments or sludges for off-site disposal. Remedy for Inner Waterway conflicts with planned land uses in this area. Remedy conflicts with planned aquatic reuse of ASB. Cornwall CAD received favorable comment during 2000 EIS for dvelopment of additional nearshore habitat.	Previous concerns raised by Port and City over creation of new nearshore fill on waterfront. Alternative does not remove impacted sediments or sludges for off-site disposal. Remedy for Inner Waterway conflicts with planned land uses in this area. Remedy conflicts with planned aquatic reuse of ASB. Use of ASB fill avoids creation of new disposal site on state-owned aquatic lands as in Alternative 2. ASB fill use reduces level of in-water construction over Alternative 2.	Waterway dredging plan is consistent with priorities identified in local land use planning process. However, Alternative does not provide for aquatic reuse of ASB. Remedy removes some contaminated sediments from waterfront, but not ASB sludges.	Alternative is consistent with planned land and navigation uses, including both Waterway and ASB areas. Provides for locally-managed multi-purpose waterway, including continued deep draft capabilities in Outer Waterway. Makes extensive use of subtitle D landfill disposal.	Alternative is consistent with planned land and navigation uses, including both Waterway and ASB areas. Provides for locally-managed multi-purpose waterway, including continued deep draft capabilities in Outer Waterway. Makes extensive use of subtitle D landfill disposal, including additional dredging near Bellingham Shipping Terminal over that performed in Alternative 5.	Dredging plan for waterway conflicts with local land and navigation planning. Emergent shallow-water habitat removed at head and along sides of waterway. Remedy requires extensive new shoreline infrastructure inconsistent with land use and navigation planning. Remedy makes greater use of Subtitle D landfill disposal, but with significant additional costs.	Dredging plan for waterway conflicts with local land and navigation planning. Emergent shallow-water habitat removed at head and along sides of waterway. Remedy requires extensive new shoreline infrastructure inconsistent with land use and navigation planning. Remedy makes greater use of Subtitle D landfill disposal, but with significant additional costs.

Notes:

Refer to Table 6-2 for a detailed description of each alternative by site unit.

1: All evaluated alternatives comply with the MTCA threshold criteria, as required by regulation.

2. These alternatives involve the creation of a new sediment disposal site which may be inconsistent with the current Shoreline Master Program.

3. Additional verification modeling would be required to demonstrate the protectiveness of this alternative for waterway areas.

4. The public comment period for the RI/FS and EIS will be used to solicit public concerns. Information contained in this table represents a concise summary of signifciant comments received during past public involvement activities.

Table 7-2. Summary of MTCA Alternatives Evaluation and Ranking

Alternative Number	**Alt. 1**	**Alt. 2**	**Alt. 3**	**Alt. 4**	**Alt. 5**	**Alt. 6**	**Alt. 7**	**Alt. 8**
Probable Cost ($Million)	$8	$34	$34	$21	$42	$44	$74	$146
Overall Alternative Ranking	Low	Medium	Medium	Medium	High	High	Low [4]	Low [4]
Alternative Description								
Waterway Remedy								
Waterway Uses	Limited-Use	Industrial	Industrial	Multi-Purpose	Multi-Purpose	Multi-Purpose	Industrial	Industrial
Sediment Disposal	None	Cornwall CAD	ASB Fill	Upland	Upland	Upland	Upland	Upland
ASB Area Remedy								
Future Uses	Non-Aquatic	Non-Aquatic	Non-Aquatic	Non-Aquatic	Aquatic	Aquatic	Aquatic	Aquatic
Sediment Disposal	None	None	ASB Fill	None	Upland	Upland	Upland	Upland
Basis for Alternative Ranking Under MTCA & SMS								
1 **Compliance with MTCA Threshold Criteria** [1] *(WAC 173-340-360(2)(a))*	Yes [3]	Yes [2]	Yes [2]	Yes	Yes	Yes	Yes	Yes
2 **Restoration Time-Frame** *(WAC 173-340-360(2)(b)(ii))*	6 to 12 yrs	6 to 9 yrs	5 to 8 yrs	3 to 4 yrs	5 to 6 yrs	5 to 6 yrs	5 to 8 yrs	8 to 13 yrs
3 **Relative Benefits Ranking for Disproportionate Cost Analysis** *(WAC 173-340-360(2)(b)(i) & WAC 173-340-360(3)(f))*	Low	Medium	Medium	Medium	High	High	Medium	Medium
Overall Protectiveness	L	M	M	M	H	H	H	H
Permanence	L	M	M	M	M	M	M	H
Long-Term Effectiveness	L	M	M	M	H	H	H	H
Short-Term Risk Management	H	M	M	H	H	H	M	L
Implementability	L	M	M	M	H	H	M	L
Consideration of Public Concerns	L	M	L	M	H	H	M	L
	L							
4 **Disproportionate Cost Analysis**								
Probable Remedy Cost ($Million)	$8	$34	$34	$21	$42	$44	$74	$146
Costs Disproportionate to Incremental Benefits	--	--	--	--	No	No	Yes	Yes
Practicability of Remedy	Practicable	Practicable	Practicable	Practicable	Practicable	Practicable	Impracticable	Impracticable
Remedy Permanent to Maximum Extent Practicable	No	No	No	No	Yes	Yes	No	No

Notes:

Refer to Table 7-1 and FS Seciton 7 for additional description of the basis for this alternatives evaluation under MTCA and SMS.

1: All evaluated alternatives comply with the MTCA threshold criteria, as required by regulation.

2. Alternatives involves creation of a new sediment disposal site which may be inconsistent with the current Shoreline Master Program.

3. Additional verification modeling would be required to demonstrate the protectiveness of this alternative for waterway areas.

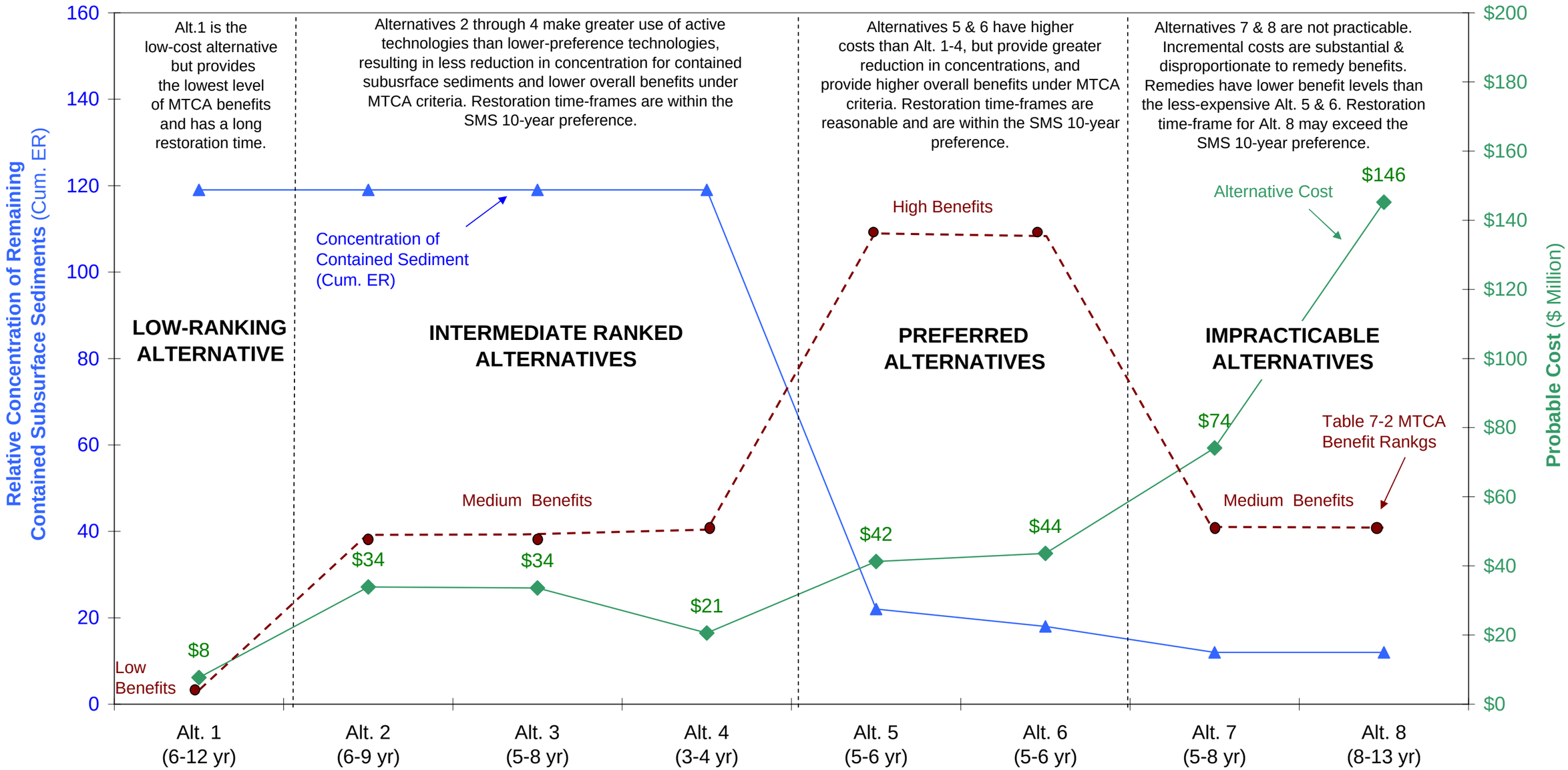
4. These alternatives are considered impracticable under MTCA, because their costs are substantial and disproportionate to the incremental benefits over the next lower-cost alternative.

5. Analysis of environmental impacts of the alternatives and of their consistency with the goals of the Bellingham Bay Demonstration Pilot is conducted in the companion EIS document. That analysis is summarized in Section 8.

Legend

L	Low: Alternative ranks unfavorably under this criterion.
M	Medium: Alternative ranks intermediate between high and low under this criterion.
H	High: Alternative ranks favorably under this criterion.

Figure 7-1.
Relationship Between Remedy Costs and Benefits



Notes:

Refer to Section 7.3 of the Feasibility Study for a discussion of MTCA benefit rankings and the disproportionate cost analysis under MTCA criteria.

8 Summary of EIS Evaluation

Section 7 of this document evaluates remedial alternatives consistent with MTCA and SMS remedy selection requirements. In addition to that evaluation, the companion Draft Supplemental EIS document provides two additional evaluations of the project alternatives consistent with SEPA and Pilot criteria.

Table 8-1 summarizes the findings of the companion EIS document. Results of the SEPA analysis are summarized in Section 8.1, and the results of the Pilot analysis are summarized in Section 8.2 below.

8.1 SEPA Impacts Analysis

The first function of the EIS is to document the environmental impacts of each of the project alternatives, consistent with the requirements of SEPA regulations. Review of potential SEPA impacts of site cleanup is also required under SMS regulations.

Where the project alternatives as described in Section 6 have significant adverse impacts that can be mitigated, appropriate mitigation measures are defined in the EIS. Where project alternatives result in net adverse impacts that are integral to the alternatives and cannot be mitigated, these are identified and discussed.

8.1.1 Elements of the Environment

SEPA regulations (WAC 197-11-444) define different elements of the environment that should be considered in the development of an EIS. Following EIS scoping, the Comprehensive Strategy 1999 draft and 2000 final EIS documents organized these SEPA environmental elements into five categories. These five categories were used in analysis of remedial alternatives as part of the Supplemental EIS. The five elements of the environment included the following:

- **Geology, Water, Environmental Health:** These factors include both the natural and built environment. The geology element includes soil and sediment stability issues. The water element focuses on water quality. The environmental health element incorporates both the pollution control benefits of conducting the cleanup, as well as potential impacts/benefits associated with implementation of the cleanup itself.

- **Fish and Wildlife:** This category includes the fish and wildlife in the project area, the different existing habitats, and the potential changes (positive and negative) to those habitats that may occur as part of the cleanup.

- **Land Use, Navigation and Public Shoreline Access:** This category includes the uses of the project area, including the aquatic areas and nearby shorelines and waterfront properties. The elements within this category focus on existing community priorities that have been defined in previous and ongoing land use planning efforts, and how these priorities are either furthered or adversely impacted by the cleanup alternatives.

- **Air and Noise:** These elements address potential impacts to existing air quality and noise levels, particularly during the construction of the cleanup.

- **Cultural Resources:** Cultural resources include existing archaeological, cultural and historical resources that may be impacted by the proposed project.

Refer to Section 3 of the companion EIS document for a complete description of the affected environment. Section 4 of that document provides the complete SEPA evaluation of the remedial alternatives. Significant SEPA findings of the remedial alternatives are described below.

8.1.2 SEPA Evaluation of Alternatives

Table 8-1 summarizes the findings of the SEPA evaluation for each of the eight RI/FS alternatives. For each element of the environment, the conclusions are summarized based on the level of net impacts to the environment, and whether any adverse impacts are mitigated within the scope of the alternative as defined in Section 6. Where additional measures may be required above-and-beyond the remedial alternative as described in the RI/FS, such mitigation measures are discussed. Significant SEPA findings for the project alternatives are as follows:

- **Alternative 1:** Alternative 1 accomplishes sediment cleanup consistent with MTCA requirements. However, the cleanup actions do not stabilize project shorelines. Because residual impacted sediments are left adjacent to unstabilized project shorelines under this alternative, net adverse impacts were noted under the first SEPA category (geology, water, environmental health). Net beneficial impacts were noted under the fish and wildlife category, because Alternative 1 retains existing nearshore aquatic habitat within the Inner Whatcom Waterway, and creates a new area of improved shallow-water habitat offshore of the ASB. Under the third SEPA category (land use, navigation & shoreline public access) Alternative 1 was found to have net adverse impacts. Alternative 1 does not address land use or navigation needs within the Whatcom Waterway channel, leaving residual contaminated sediments at locations and elevations that conflict with planned

waterway uses. Further, Alternative 1 conflicts with aquatic reuse plans for the ASB. Like all of the remediation alternatives, cleanup implementation will result in some impacts under SEPA category 4 (air and noise impacts), though these can be mitigated through compliance with applicable regulatory requirements and best practices. Alternative 1 does not involve dredging within the Whatcom Waterway, minimizing the risk of disturbance of historical or cultural artifacts.

- **Alternative 2:** Alternative 2 is expected to comply with MTCA cleanup requirements, protecting water quality and environmental health. However, the alternative requires deep dredging within the Inner Whatcom Waterway area, which will destabilize project shorelines. This shoreline destabilization represents a net adverse impacts under SEPA category 1 (geology, water, environmental health) that will require mitigation. Mitigation will including the construction of bulkheads and hardened shoreline infrastructure to prevent shoreline collapse and permit use and maintenance of target dredge depths. Probable costs for the construction of this deep draft infrastructure are estimated at $30 million, not including long-term maintenance. Alternative 2 was found to have net beneficial impacts under SEPA category 2 (fish & wildlife), through anticipated net gains in the quantity of shallow-water, nearshore habitat. Sediments removed from the Whatcom Waterway by dredging the would be managed using a new containment facility constructed near the Cornwall Avenue Landfill. The design and operation of the facility would be generally consistent with that defined in the 2000 Pilot FEIS. The containment facility is assumed under this alternative to be constructed so that the top layer of the facility remained submerged, with an elevation suitable for development of premium shallow-water habitat. This habitat would offset losses of existing nearshore aquatic habitat in the Inner Whatcom Waterway associated with dredging of the 1960s federal channel. Under SEPA category 3 (land use, navigation & shoreline public access) Alternative 2 is expected to result in net adverse impacts. The deep dredging and associated shoreline infrastructure requirements of this alternative are inconsistent with planned mixed-use redevelopment of the Inner Whatcom Waterway. The bulkheads and other infrastructure are in direct conflict with planned habitat enhancements and the construction of deep draft infrastructure will be in conflict with community land use planning efforts. The use restrictions associated with the 1960's federal channel also conflict with local priorities for public shoreline access and environmental enhancements in the Inner Whatcom Waterway areas. The capping in-place of the ASB sludges is in direct conflict with planned aquatic reuse of this area. The land use and navigation impacts of

Alternative 2 cannot be mitigated, but are intrinsic to this alternative. Like all of the remediation alternatives, cleanup implementation will result in some adverse impacts under SEPA category 4 (air and noise impacts), though these can be mitigated through compliance with applicable regulatory requirements and best practices. Alternative 2 will involve dredging at the head of Whatcom Waterway, raising a potential for disturbance of historical or cultural resources (SEPA category 5). These impacts would need to be mitigated through appropriate planning, archaeological monitoring and/or other measures.

- **Alternative 3:** Alternative 3 is expected to comply with MTCA cleanup requirements, protecting water quality and environmental health. However, the alternative requires deep dredging within the Inner Whatcom Waterway area, which will destabilize project shorelines. This shoreline destabilization represents a net adverse impacts under SEPA category 1 (geology, water, environmental health) that will require mitigation. Mitigation will including the construction of bulkheads and hardened shoreline infrastructure to prevent shoreline collapse and permit use and maintenance of target dredge depths. Probable costs for the construction of this deep draft infrastructure are estimated at $30 million, not including long-term maintenance. Alternative 3 is likely to produce net adverse impacts under SEPA category 2 (fish & wildlife), through anticipated net loss in the quantity of shallow-water, nearshore habitat. Sediments removed from the Whatcom Waterway by dredging the would be managed by construction a nearshore fill within the ASB, without creation of new nearshore habitat as in Alternative 2. Some nearshore habitat is constructed offshore of the ASB, but this habitat enhancement may not be sufficient to offset losses of existing nearshore aquatic habitat in the Inner Whatcom Waterway associated with dredging of the 1960s federal channel. Additional habitat mitigation is likely to be required. Under SEPA category 3 (land use, navigation & shoreline public access) Alternative 3 is expected to result in net adverse impacts. The deep dredging and associated shoreline infrastructure requirements of this alternative are inconsistent with planned mixed-use redevelopment of the Inner Whatcom Waterway. The bulkheads and other infrastructure are in direct conflict with planned habitat enhancements. and the construction of deep draft infrastructure will be in conflict with community land use planning efforts. The use restrictions associated with the 1960's federal channel also conflict with local priorities for public shoreline access and environmental enhancements in the Inner Whatcom Waterway areas. The construction of the nearshore fill within the ASB is in direct conflict with planned aquatic reuse of this area. The land use and navigation impacts of Alternative 3 cannot be

mitigated, but are intrinsic to this alternative. Like all of the remediation alternatives, cleanup implementation will result in some adverse impacts under SEPA category 4 (air and noise impacts), though these can be mitigated through compliance with applicable regulatory requirements and best practices. Alternative 3 will involve dredging at the head of Whatcom Waterway, raising a potential for disturbance of historical or cultural resources (SEPA category 5). These impacts would need to be mitigated through appropriate planning, archaeological monitoring and/or other measures.

- **Alternative 4:** Alternative 4 is expected to comply with MTCA cleanup requirements, protecting water quality and environmental health. Unlike previous alternatives 1-3, Alternative 4 conducts remediation of the Inner Whatcom Waterway area consistent with the multi-purpose waterway concept. Capping and stabilization of Inner Whatcom Waterway shorelines will be accomplished as part of the implementation of this alternative, in a manner consistent with planned land and navigation uses in this area. Alternative 4 therefore achieves net beneficial impacts under SEPA category 1 (geology, water, environmental health). There are some habitat impacts under Alternative 4, but these are offset by habitat gains through preservation and construction of nearshore habitat. Alternative 4 produces a net beneficial impact under SEPA category 2 (fish & wildlife). Under SEPA category 3 (land use, navigation & shoreline public access), this alternative results in net adverse impacts that cannot be mitigated. The alternative avoids the deep dredging and associated shoreline infrastructure requirements of Alternatives 2 and 3, and hence avoids navigation and land use conflicts in the Inner Whatcom Waterway. However, the capping of the ASB sludges results in direct conflicts with planned aquatic reuse of this area. The land use and navigation impacts of Alternative 4 cannot be mitigated, and are intrinsic to this alternative. Like all of the remediation alternatives, cleanup implementation will result in some adverse impacts under SEPA category 4 (air and noise impacts), though these can be mitigated through compliance with applicable regulatory requirements and best practices. Alternative 4 will involve dredging in the Whatcom Waterway, but dredging at the head of Whatcom Waterway is minimized, increasing protection for potential historical or cultural resources. Potential impacts under SEPA category 5 can be mitigated through appropriate project design and archeological review.

- **Alternative 5:** Alternative 5 is expected to comply with MTCA cleanup requirements, protecting water quality and environmental health. Like Alternative 4, this alternative conducts remediation of

the Inner Whatcom Waterway area consistent with the multi-purpose waterway concept. Dredging, capping and stabilization of Inner Whatcom Waterway shorelines will be accomplished as part of the implementation of this alternative, in a manner consistent with planned land and navigation uses in this area. Alternative 5 therefore achieves net beneficial impacts under SEPA category 1 (geology, water, environmental health). There are some habitat impacts under Alternative 5, but these are offset by a substantial net gain in the quantity of nearshore habitat. In addition to the habitat improvements included in Alternative 4, Alternative 5 accomplishes remediation of the ASB, and the ASB is reconnected to the surface waters of Bellingham Bay. This increases open-water habitat by approximately 28 acres, and introduces nearly 4,500 linear feet of salmonid migration corridor in an area formerly cut off from Bellingham Bay. Alternative 5 produces a net beneficial impact under SEPA category 2 (fish & wildlife). Under SEPA category 3 (land use, navigation & shoreline public access), this alternative results in net beneficial impacts. The alternative accomplishes implementation of the multi-purpose channel concept, including deep dredging at the Bellingham Shipping Terminal, and dredging, capping and shoreline stabilization in the Inner Whatcom Waterway. Shorelines in this area are reconstructed in a manner consistent with planned mixed use redevelopment of the Inner Whatcom Waterway. Remediation of the ASB facilitates planned aquatic reuse of this area for construction of a marina with integrated public access and habitat enhancements. Like all of the remediation alternatives, cleanup implementation will result in some adverse impacts under SEPA category 4 (air and noise impacts), though these can be mitigated through compliance with applicable regulatory requirements and best practices. Alternative 5 will involve dredging in the Whatcom Waterway, but dredging at the head of Whatcom Waterway is minimized, increasing protection for potential historical or cultural resources. Potential impacts under SEPA category 5 can be mitigated through appropriate project design and archeological review.

- **Alternative 6:** Most elements of Alternative 6 are identical to those of Alternative 5. Alternative 6 results in net beneficial impacts under the first three of the SEPA categories, and results in mitigated impacts under the fourth and fifth category. The main difference between Alternative 6 and Alternative 5 is the increased use of dredging near the Bellingham Shipping Terminal. This increased dredging is compatible with planned navigation and land uses, and does not result in requirements for new shoreline infrastructure. The deeper dredging does not trigger new habitat impacts, because the dredging is confined to deep-water areas. As

a result, the additional dredging does not result in new adverse impacts under SEPA categories. In fact, the additional dredging provides additional benefits under the third SEPA category (land use, navigation & shoreline public access) by supporting potential future deepening of the Outer Whatcom Waterway, should that be required in the future.

- **Alternative 7:** Alternative 7 is expected to comply with MTCA cleanup requirements, protecting water quality and environmental health. However, the alternative requires deep dredging within the Inner Whatcom Waterway area, which will destabilize project shorelines. This shoreline destabilization represents a net adverse impacts under SEPA category 1 (geology, water, environmental health) that will require mitigation. Mitigation will including the construction of bulkheads and hardened shoreline infrastructure to prevent shoreline collapse and permit use and maintenance of target dredge depths. Probable costs for the construction of this deep draft infrastructure are estimated at $30 million, not including long-term maintenance. Alternative 7 is likely to produce mitigated adverse impacts under SEPA category 2 (fish & wildlife), through anticipated impacts to existing shallow-water, nearshore habitat. As with Alternatives 5 and 6, nearshore habitat improvements are accomplished as part of the remediation of the ASB, and construction of a sediment cap offshore of the ASB. This additional habitat is expected to offset the destruction of nearshore habitat at the head and along the sides of the Whatcom Waterway. Additional habitat mitigation is not likely to be required under Alternative 7. Under SEPA category 3 (land use, navigation & shoreline public access) Alternative 7 is expected to result in net adverse impacts. The deep dredging and associated shoreline infrastructure requirements of this alternative are inconsistent with planned mixed-use redevelopment of the Inner Whatcom Waterway. The bulkheads and other infrastructure are in direct conflict with planned habitat enhancements, and the construction of deep draft infrastructure will be in conflict with community land use planning efforts. The use restrictions associated with the 1960's federal channel also conflict with local priorities for public shoreline access and environmental enhancements in the Inner Whatcom Waterway areas. These land use and navigation impacts cannot be mitigated, but are intrinsic to this alternative. Like all of the remediation alternatives, cleanup implementation will result in some adverse impacts under SEPA category 4 (air and noise impacts), though these can be mitigated through compliance with applicable regulatory requirements and best practices. Alternative 7 will involve dredging at the head of Whatcom Waterway, raising a potential for disturbance of historical or cultural resources (SEPA category 5). These impacts would need to be mitigated through

appropriate planning, archaeological monitoring and/or other measures.

- **Alternative 8:** Alternative 8 is expected to comply with MTCA cleanup requirements, protecting water quality and environmental health. However, the alternative requires deep dredging within the Inner Whatcom Waterway area, which will destabilize project shorelines. This shoreline destabilization represents a net adverse impacts under SEPA category 1 (geology, water, environmental health) that will require mitigation. Mitigation will including the construction of bulkheads and hardened shoreline infrastructure to prevent shoreline collapse and permit use and maintenance of target dredge depths. Probable costs for the construction of this deep draft infrastructure are estimated at $30 million, not including long-term maintenance. Alternative 8 is likely to produce net adverse impacts under SEPA category 2 (fish & wildlife), through anticipated impacts to existing shallow-water, nearshore habitat. As with Alternatives 5 and 6, nearshore habitat improvements are accomplished as part of the remediation of the ASB. However, Alternative 8 converts nearshore habitat to deep-water habitat in areas offshore and adjacent to the ASB. These conversions represent net adverse impacts to juvenile salmonid habitat. In addition to the destruction of nearshore habitat at the head and along the sides of the Whatcom Waterway, Alternative 8 is likely to result in a net adverse impacts to fish and wildlife. Additional habitat mitigation is likely to be required under Alternative 8. Under SEPA category 3 (land use, navigation & shoreline public access) Alternative 8 is expected to result in net adverse impacts. The deep dredging and associated shoreline infrastructure requirements of this alternative are inconsistent with planned mixed-use redevelopment of the Inner Whatcom Waterway. The bulkheads and other infrastructure is in direct conflict with planned habitat enhancements in this area, and the construction of deep draft infrastructure will be in conflict with area redevelopment planning. The use restrictions associated with the 1960's federal channel also conflict with local priorities for public shoreline access and environmental enhancements in the Inner Whatcom Waterway areas. These land use and navigation impacts cannot be mitigated, but are intrinsic to this alternative. Of the evaluated remediation alternatives, implementation of Alternative 8 will result in the greatest adverse impacts under SEPA category 4 (air and noise impacts), though these can be mitigated through compliance with applicable regulatory requirements and best practices. Alternative 8 will involve dredging at the head of Whatcom Waterway, raising a potential for disturbance of historical or cultural resources (SEPA category 5). These impacts

would need to be mitigated through appropriate planning, archaeological monitoring and/or other measures.

8.2 Pilot Comparative Analysis

In addition to its strict SEPA regulatory role, the EIS also evaluates each of the project alternatives for its consistency with the seven goals of the Bellingham Bay Demonstration Pilot. Consistency with these goals is not required under MTCA or SMS regulations. However, the Pilot Goals capture the results of over ten years of coordinated cleanup, source control and habitat restoration planning in Bellingham Bay. Alternatives that have a high degree of consistency with the Pilot goals are considered to provide greater overall benefits relative to the stated priorities of the Pilot team members.

8.2.1 Seven Pilot Goals

As described in the project EIS document, the Bellingham Bay Demonstration Pilot was established in 1996 with the stated mission to use a new cooperative approach to expedite source control, sediment cleanup and associated habitat restoration in Bellingham Bay. The Pilot Team included regulatory and resource agencies, the City of Bellingham, the Port of Bellingham, the Lummi Nation, the Nooksack Tribe and other key community groups and stakeholders. The Pilot included extensive community involvement and public outreach activities.

Using consensus-based decision-making, the Pilot Team established seven "baywide" goals that it wanted to ultimately achieve. The goals were formally adopted by the multi-agency work group in 1997, and these goals provide an additional benchmark against which the appropriateness of the preferred alternatives can be measured. The seven Pilot goals are as follows:

Goal 1 -- Human Health and Safety: *Implement actions that will enhance the protection of human health.*

Goal 2 – Ecological Health*: Implement actions that will protect and improve the ecological health of the bay.*

Goal 3 – Protect and Restore Ecosystems: *Implement actions that will protect, restore or enhance habitat components making up the bay's ecosystem.*

Goal 4 – Social and Cultural Uses: *Implement actions that are consistent with or enhance cultural and social uses in the bay and surrounding vicinity.*

Goal 5 – Resource Management: *Maximize material re-use in implementing sediment cleanup actions, minimize the use of non-*

renewable resources, and take advantage of existing infrastructure where possible instead of creating new infrastructure.

Goal 6 – Faster, Better, Cheaper: *Implement actions that are more expedient and more cost-effective, through approaches that achieve multiple objectives.*

Goal 7 – Economic Vitality: *Implement actions that enhance water-dependent uses of shoreline property.*

8.2.2 Pilot Ranking of Alternatives

As shown in Table 8-1, each of the alternatives was qualitatively ranked under each of the seven goals based on the ability of the alternative to further that goal. Qualitative rankings were applied as either "Low," "Medium," or "High." A "high" ranking indicates that the alternative provides better progress toward that Pilot goal than other alternatives ranked as "Low," or "Medium." Composite rankings were then applied based on the average results of the seven individual rankings for each alternative.

The following discussion presents the composite Pilot rankings for each of the eight RI/FS alternatives, along with a summary of key differences among the alternatives. For additional discussion, refer to Section 5 of the EIS document.

- **Alternative 1:** Alternative 1 received a low composite ranking under the Pilot evaluation. The Alternative ranked medium for Goal 1 (human health & safety) and Goal 2 (ecological health). Though the cleanup is expected to comply with MTCA cleanup levels protective of human health and the environment, the alternative does not conduct cleanup using solutions considered to be permanent to the maximum extent practicable under MTCA, and hence does not receive a high ranking under these two goals. Alternative 1 was ranked medium under Goal 3 (habitat protection & restoration). Under Alternative 1, shallow-water habitat areas are preserved at the head and along the sides of the Inner Whatcom Waterway, and capping produces a beneficial change in sediment elevation and energy levels in the area offshore of the ASB. However, the alternative does not facilitate the removal of Inner Whatcom Waterway bulkheads or over-water structures as in Alternatives 5 and 6, nor does it achieve restoration of aquatic uses for the ASB as in Alternatives 5 through 8. Alternative 1 receives low rankings for Goal 4 (social & cultural uses), because the dredging plan for the Inner Whatcom Waterway is not consistent with land use and navigation planning for this area, and the capping of the ASB is inconsistent with planned aquatic reuse of the ASB. Alternative 1 ranks low for Goal 5 (resource management). Even though Alternative 1 conserves resources by minimizing construction activity, the alternative does not allow for reuse of clean ASB berm material, and it impedes the

continued use of the deep draft navigation infrastructure present at the Bellingham Shipping Terminal. For Goal 6 (faster, better, cheaper) Alternative 1 receives a low ranking. Though the alternative provides short-term cost savings over the other more costly alternatives, Alternative 1 does not address the long-term waterfront land and navigation uses. Therefore, this alternative is cheaper, but is not necessarily better. Under Goal 7 (economic vitality, shoreline land use) Alternative 1 receives a low ranking, because the alternative is not consistent with planned land or navigation uses for either the Whatcom Waterway or the ASB area.

- **Alternative 2:** Alternative 2 received a medium composite ranking under the Pilot evaluation. The Alternative ranked medium for Goal 1 (human health & safety) and Goal 2 (ecological health). Though the cleanup is expected to comply with MTCA cleanup levels protective of human health and the environment, the alternative does not conduct cleanup using solutions considered to be permanent to the maximum extent practicable under MTCA, and hence does not receive a high ranking under these two goals. Alternative 2 receives a high ranking under Goal 3 (habitat protection & restoration). Alternative 2 produces negative habitat impacts in the Inner Whatcom Waterway, through the removal of emergent shallow-water habitat from the head and sides of the waterway, the triggering of shoreline infrastructure requirements that further affect habitat quality in the Inner Whatcom Waterway, and through prevention of aquatic reuse of the ASB. However, Alternative 2 creates new premium shallow-water aquatic habitat at the Cornwall CAD facility, offsetting other habitat losses and providing an anticipated net gain of nearshore habitat. Alternative 2 receives a low ranking under Goal 4 (social and cultural uses) because the dredging plan for the Whatcom Waterway is not consistent with planed mixed-use redevelopment of this area, and because the alternative triggers shoreline infrastructure requirements that are in conflict with area land use and navigation priorities. The dredging performed under these alternatives results in potential disturbance to cultural or historical resources in the former Citizen's Dock area at the head of Whatcom Waterway, and Alternative 2 also does not support planned aquatic reuse of the ASB. Alternative 2 receives a medium ranking under Goal 5 (resource management). Alternative 2 minimizes the use of non-renewable fuel resources required to transport dredged materials off of the waterfront. However, Alternative 2 triggers the creation of new infrastructure that will be costly to create, will produce redundancies with the existing infrastructure present at the Bellingham Shipping Terminal, and will be in conflict with community land use priorities for the Inner Whatcom Waterway. Alternative 2 receives a medium ranking under Goal 6 (faster, better cheaper). While the costs of the alternative are lower than those of the MTCA preferred alternatives, this cost-effectiveness is eliminated after the costs of additional shoreline

infrastructure requirements are taken into account. Further, the alternative does not capture new funding sources (i.e., marina revenues) which the Port plans to apply to offset a portion of the cleanup costs under Alternatives 5 through 8. Under Goal 7 (economic vitality, shoreline land use) Alternative 2 receives a low ranking, because the alternative is not consistent with planned land or navigation uses for either the Whatcom Waterway or the ASB area.

- **Alternative 3:** Alternative 3 receives a medium composite ranking under the Pilot evaluation. The Alternative ranked medium for Goal 1 (human health & safety) and Goal 2 (ecological health). The cleanup is expected to comply with MTCA cleanup levels protective of human health and the environment, but the alternative does not conduct cleanup using solutions considered to be permanent to the maximum extent practicable under MTCA. Alternative 3 receives a low ranking under Goal 3 (habitat protection & restoration). Alternative 3 produces negative habitat impacts in the Inner Whatcom Waterway, through the removal of emergent shallow-water habitat from the head and sides of the waterway, the triggering of shoreline infrastructure requirements that further affect habitat quality in the Inner Whatcom Waterway. The Alternative includes some enhancement of habitat quality offshore of the ASB, but does not enhance habitat to the extent conducted in other project alternatives. Alternative 3 receives a low ranking under Goal 4 (social and cultural uses) because the dredging plan for the Whatcom Waterway is not consistent with planed mixed-use redevelopment of this area, and because the alternative triggers shoreline infrastructure requirements that are in conflict with area land use and navigation priorities. The dredging performed under these alternatives results in potential disturbance to cultural or historical resources in the former Citizen's Dock area at the head of Whatcom Waterway, and Alternative 3 also does not support planned aquatic reuse of the ASB. Alternative 3 receives a medium ranking under Goal 5 (resource management). Alternative 3 minimizes the use of non-renewable fuel resources required to transport dredged materials off of the waterfront. However, Alternative 3 triggers the creation of new infrastructure that will be costly to create, will produce redundancies with the existing infrastructure present at the Bellingham Shipping Terminal, and will be in conflict with community land use priorities for the Inner Whatcom Waterway. Alternative 3 receives a medium ranking under Goal 6 (faster, better cheaper). While the costs of the alternative are lower than those of the MTCA preferred alternatives, this cost-effectiveness is eliminated after the costs of additional shoreline infrastructure requirements are taken into account. Further, the alternative does not capture new funding sources (i.e., marina revenues) which the Port plans to apply to offset a portion of the cleanup costs under Alternatives 5 through 8. Under Goal 7 (economic vitality, shoreline land use) Alternative 3 receives a low ranking, because the alternative is not

consistent with planned land or navigation uses for either the Whatcom Waterway or the ASB area. Alternative 3 creates new fill areas in the Central Waterfront that will be encumbered by geotechnical concerns and environmental use restrictions.

- **Alternative 4:** Alternative 4 ranked medium overall against the seven Pilot Goals. As with Alternatives 1-3, the alternative complies with cleanup standards, but does not use permanent solutions to the maximum extent practicable. This results in medium rankings under Pilot Goals 1 and 2. The ranking against Goal 3 (habitat protection & restoration) is medium. Alternative 4 preserves and restores some nearshore, shallow-water habitat within the Inner Whatcom Waterway and offshore of the ASB, but the alternative does not restore aquatic use of the ASB as under Alternatives 5 through 8. Alternative 4 earns a "medium" ranking under Goal 4 (social & cultural uses). The alternative provides for multiple uses of the Whatcom Waterway consistent with land use and navigation planning, and avoids disturbance of potential historical and cultural resources at the head of the Whatcom Waterway near former Citizen's dock. However, the alternative does not support aquatic reuse of the ASB. Alternative 4 receives a medium ranking for Goal 5 (resource management). Alternative 4 reduces the non-renewable resources consumed during construction activities, and avoids the redundant shoreline infrastructure requirements of alternatives 2 and 3. However, Alternative 4 does not provide for reuse of clean ASB berm materials. Alternative 4 receives a medium ranking for Goal 6 (faster, better, cheaper). While the alternative can be implemented quickly, and the project is cost-effective, the alternative does not achieve restoration of aquatic uses within the ASB, and does not provide the degree of habitat, navigation and public access enhancements achieved by Alternatives 5 and 6. Further, the alternative does not capture the additional funding source (marina revenues) of these other alternatives. Alternative 4 achieves partial consistency with shoreline land use priorities, and receives a "medium" ranking under Pilot Goal 7 (economic vitality, shoreline land use). The alternative tailors the dredging and shoreline modifications within the Whatcom Waterway to the multi-purpose channel concept. However, the alternative is inconsistent with planned aquatic reuse of the ASB.

- **Alternative 5:** Alternatives 5 receives a high composite ranking based on evaluation against the seven Pilot goals. Cleanup under Alternative 5 is conducted using solutions that are permanent to the maximum extent practicable under MTCA, resulting in high rankings under Goal 1 (human health & safety) and Goal 2 (ecological health). Alternative 5 receives a high ranking under Goal 3 (habitat protection & restoration) because it preserves nearshore, shallow water habitat within the Inner Whatcom Waterway and offshore of the ASB and restores aquatic use of the ASB. Under Alternatives 5 and 6, the ASB is cleaned up and

then reconnected to Bellingham Bay. This restores nearly 4,500 linear feet of salmonid migration corridor, and opens approximately 28 acres of open water habitat. The restoration of the ASB will represent one of the largest habitat restoration projects achieved in the Puget Sound area. Alternative 5 also ranks high under Goal 4 (social & cultural uses). The alternative provides for multiple uses of the Whatcom Waterway consistent with land use and navigation planning. The alternatives enhance social and cultural uses by directly supporting revitalization of the Bellingham waterfront. The cleanup actions within the ASB and the Whatcom Waterway are consistent with land use and navigation planning., while avoiding disturbance of potential historical and cultural resources at the head of the Whatcom Waterway near former Citizen's dock. Alternative 5 receives a "high" ranking under Pilot Goal 5 (resource management). The alternative uses significant energy resources to accomplish project construction. However, these resources are used appropriately to manage the most heavily-contaminated materials requiring cleanup, and the cleanup action provides for reuse of the clean ASB berm materials. Alternative 5 avoid the creation of redundant shoreline infrastructure that conflicts with area land use priorities. Under Goal 6 (faster, better, cheaper), Alternative 5 is ranked high because it provides a high-quality cleanup action consistent with planned land uses, while maintaining overall cost-effectiveness. The cleanup actions of Alternative 5 are more costly than Alternatives 1-4, but overall costs are reasonable if mitigation costs costs are considered as part of the analysis. Additionally, Alternative 5 provides for planned aquatic reuse of the ASB, which is expected to generate additional revenues (marina moorage fees) that help offset the costs of ASB sludge removal. Alternative 5 receives a high ranking for Goal 7 (economic vitality, shoreline land use) by enhancing water-dependent uses of shoreline property, providing for a full range of waterfront uses, and contributing to the revitalization of Bellingham Bay waterfront.

- **Alternative 6:** Like Alternative 5, Alternative 6 receives a high composite ranking relative to the seven Pilot goals. Most elements of Alternative 6 are the same as for Alternative 5. The principal difference is that Alternative 6 conducts additional deep dredging adjacent to the Bellingham Shipping Terminal, reducing the area of capping required within Whatcom Waterway. This additional dredging results in some increases to project costs, but with a corresponding potential benefit to future navigation uses at Bellingham Shipping Terminal, should additional navigation depths be required. Therefore, the additional costs of Alternative 6 do not affect rankings of the alternative under Goals 5 (resource management), or under Goal 6 (faster, better, cheaper). All other rankings are high, as in Alternative 5.

- **Alternative 7:** Alternative 7 receives a medium composite ranking relative to the seven Pilot Goals. Alternative 7 receives high rankings

for Goal 1 (human health & safety) and for Goal 2 (ecological health), because the level of cleanup meets or exceeds MTCA requirements. The use of dredging and upland disposal beyond the point considered the maximum extent practicable under MTCA does not affect the rankings against these goals, though it does impact the Goal 6. Alternative 7 receives a medium ranking under Goal 3 (habitat protection and restoration). Alternative 7 enhances habitat quality through aquatic reuse of the ASB, and through creation of a cap and habitat bench offshore of the ASB. However, the dredging of the 1960s industrial channel removes emergent shallow-water habitat at the head and along the sides of the Inner Whatcom Waterway, and triggers requirements for hardened shoreline infrastructure that further limit habitat quality in this area. The ranking of Alternatives 7 against Goal 4 (social & cultural uses) is low. The dredging of the 1960s federal channel and the associated requirements for hardened shoreline infrastructure are inconsistent with area land use and navigation planning, and could disturb historical or archaeological resources that may be present near the former Citizen's Dock area. Ranking under Goal 5 (resource management) is low, due to the higher consumption of non-renewable fossil fuel resources during dredging and infrastructure construction, and due to likely redundancy of newly-constructed infrastructure with existing infrastructure at the Bellingham Shipping Terminal. Alternative 7 receives a low ranking for Goal 6 (faster, better, cheaper) because costs of this alternative are substantially higher than those of Alternative 6, and environmental, land use and habitat benefits are equivalent or lower. This poor cost/benefit relationship is compounded when the costs of required shoreline infrastructure are incorporated into project estimates. Finally, Alternative 7 receives a low ranking for Goal 7 (economic vitality, shoreline land use) due to the poor cost-effectiveness of the alternative, and due to the conflicts between the alternative and planned land uses in the Inner Whatcom Waterway.

- **Alternative 8:** Alternative 8 receives a low composite ranking relative to the seven Pilot criteria. Rankings for Goal 1 (human health & safety) and for Goal 2 (ecological health) were high, because this alternative makes the greatest use of permanent solutions. However, the use of dredging and upland disposal beyond the point at which it is considered practicable under MTCA results in low rankings for Goal 6 (faster, better, cheaper). Alternative 8 receives a low ranking under Goal 3 (habitat protection and restoration). Alternative 8 removes emergent shallow-water habitat from the head and sides of the Inner Whatcom Waterway. In addition, Alternative 8 converts shallow-water habitat in the area offshore of the ASB to less-productive deep-water habitat, rather than enhancing habitat quality of this area as in preceding alternatives. Despite habitat enhancements conducted within the ASB, this alternative likely results in a net loss of premium nearshore aquatic habitat. The ranking of Alternatives 7 against Goal 4 (social & cultural

uses) is low. The dredging of the 1960s federal channel and the associated requirements for hardened shoreline infrastructure are inconsistent with area land use and navigation planning, and could disturb historical or archaeological resources that may be present near the former Citizen's Dock area. Ranking under Goal 5 (resource management) is low, because Alternative 8 has the highest consumption of non-renewable fossil fuel resources during dredging and infrastructure construction, and because the new shoreline infrastructure will likely be redundant with existing infrastructure at the Bellingham Shipping Terminal. Alternative 7 receives a very low ranking for Goal 6 (faster, better, cheaper) because costs of this alternative are over three times higher than the MTCA preferred alternative, without producing a significant enhancement to site environmental conditions or other benefits. This poor cost-effectiveness is compounded when the costs of required shoreline infrastructure are incorporated into project estimates. Finally, Alternative 8 receives a low ranking for Goal 7 (economic vitality, shoreline land use) due to the poor cost-effectiveness of the alternative, and due to the conflicts between the alternative and planned land uses in the Inner Whatcom Waterway.

8.3 Comparison of RI/FS and EIS Findings

Table 8-1 summarizes the results of the EIS analysis. These findings can be compared to the results of the MTCA alternatives rankings shown in Table 7-2.

Based on the SEPA analysis as summarized in Section 8.1 above, most of the project alternatives will require mitigation measures over-and-above the elements of the MTCA remedy design concepts. Mitigation measures defined in the SEPA analysis should be considered as part of cleanup planning and implementation. Incremental costs of mitigation will affect the overall cost of each alternative. Alternatives 5 and 6 had net beneficial impacts or mitigated impacts under the SEPA criteria, indicating that required mitigation measures will be minimal for implementation of these alternatives.

The Pilot analysis of alternatives summarized in Section 8.2 is different from MTCA or SEPA in that it is not required under existing regulatory authorities. Consistency with the Bellingham Bay Comprehensive Strategy and the Pilot Goals is voluntary. However, the use of the Pilot goals provides an additional basis by which the qualitative benefits or short-comings of a remedial alternative can be measured. In general, the relative Pilot rankings were similar to the MTCA alternatives rankings. Alternatives 1 and 8 ranked lowest. Alternatives 2, 3, 4 and 7 ranked medium. Alternatives 5 and 6, which were the MTCA preferred remedial alternatives, also received the highest rankings against Pilot goals.

Table 8-1. Summary of EIS Alternatives Analysis

Alternative Number	**Alt. 1**	**Alt. 2**	**Alt. 3**	**Alt. 4**	**Alt. 5**	**Alt. 6**	**Alt. 7**	**Alt. 8**
Probable Cost ($Million)	$8	$34	$34	$21	$42	$44	$74	$146
Alternative Description	Fig 6-1	Fig 6-2	Fig 6-3	Fig 6-4	Fig 6-5	Fig 6-6	Fig 6-7	Fig 6-8
Waterway Remedy								
Waterway Uses	Limited-Use	Industrial	Industrial	Multi-Purpose	Multi-Purpose	Multi-Purpose	Industrial	Industrial
Sediment Disposal	None	Cornwall CAD	ASB Fill	Upland	Upland	Upland	Upland	Upland
ASB Area Remedy								
Future Uses	Non-Aquatic	Non-Aquatic	Non-Aquatic	Non-Aquatic	Aquatic	Aquatic	Aquatic	Aquatic
Sediment Disposal	None	None	ASB Fill	None	Upland	Upland	Upland	Upland
SEPA Analysis of Impacts, Benefits & Mitigation (EIS Section 4)								
Elements of the Environment *(WAC 197-11-444)* [1]								
1 Geology, Water, Environmental Health	Net Adverse Impacts	Net Adverse Impacts	Net Adverse Impacts	Net Beneficial Impacts	Net Beneficial Impacts	Net Beneficial Impacts	Net Adverse Impacts	Net Adverse Impacts
2 Fish & Wildlife	Net Beneficial Impacts	Net Beneficial Impacts	Net Adverse Impacts	Net Beneficial Impacts	Net Beneficial Impacts	Net Beneficial Impacts	Mitigated Impacts	Net Adverse Impacts
3 Land Use, Navigation & Shoreline Public Access	Net Adverse Impacts	Net Adverse Impacts	Net Adverse Impacts	Net Adverse Impacts	Net Beneficial Impacts	Net Beneficial Impacts	Net Adverse Impacts	Net Adverse Impacts
4 Air & Noise	Mitigated Impacts	Mitigated Impacts	Mitigated Impacts	Mitigated Impacts	Mitigated Impacts	Mitigated Impacts	Mitigated Impacts	Mitigated Impacts
5 Historic & Cultural Preservation	-- No Change	Mitigated Impacts	Mitigated Impacts	Mitigated Impacts	Mitigated Impacts	Mitigated Impacts	Mitigated Impacts	Mitigated Impacts
Pilot Comparative Analysis of Alternatives (EIS Section 5)								
Overall Ranking of Alternative Against Pilot Goals	Low	Medium	Medium	Medium	High	High	Medium	Low
1 *Human Health & Safety*	Medium	Medium	Medium	Medium	High	High	High	High
2 *Ecological Health*	Medium	Medium	Medium	Medium	High	High	High	High
3 *Habitat Protection & Restoration*	Medium	High	Low	Medium	High	High	Medium	Low
4 *Social & Cultural Uses*	Low	Low	Low	Medium	High	High	Low	Low
5 *Resource Management*	Low	Medium	Medium	Medium		High	Low	Low
6 *Faster, Better, Cheaper*	Low	Medium	Medium	Medium	High	High	Low	Very Low
7 *Economic Vitality, Shoreline Land Use*	Low	Low	Low	Medium	High	High	Low	Low

Notes:

1. Consistent with WAC 197-11-444(3), the SEPA environmental elements have been combined to improve readability and to focus on significant issues. Categorization of the environmental elements was performed consistent with the Comprehensive Strategy 2000 FEIS.

9 Summary and Conclusions

This Feasibility Study presents a comprehensive analysis of cleanup requirements applicable to the Whatcom Waterway site. After establishing Site Units and screening potentially applicable cleanup technologies, eight comprehensive cleanup alternatives were evaluated and ranked for compliance with regulatory requirements. The alternatives are described in detail in Section 6. The evaluation of alternatives under MTCA and SMS regulations is included in Section 7.

9.1 Description of the Preferred Alternatives

Based on the analysis described in Section 7, two preferred alternatives (Alternatives 5 and 6) have been identified. Key elements of the two MTCA Preferred Alternatives include the following:

- **Remedial Technologies:** Contaminated sediments are remediated using both active and passive remedial technologies including dredging, sediment treatment, upland Subtitle D disposal, reuse and recycling, capping, monitored natural recovery and institutional controls.

- **ASB Cleanup:** The ASB will be remediated by removing, treating and disposing of the accumulated sludges, the most impacted site materials requiring remediation. As part of the cleanup action, the ASB area will be remediated and restored to aquatic uses. The cleanup is consistent with plans for aquatic reuse of the ASB for construction of an environmentally sustainable marina with integrated habitat enhancement and public access improvements.

- **Whatcom Waterway Cleanup:** The Whatcom Waterway will be remediated consistent with the requirements of a locally-managed, multi-purpose channel. Sediment removal is conducted in the Outer Whatcom Waterway to maintain deep draft navigation uses with water depths of at least 30 feet, consistent with area land use planning and existing infrastructure at the Bellingham Shipping Terminal. The Inner Whatcom Waterway is managed to accommodate multiple uses including habitat enhancement, public shoreline access, and sustainable navigation uses consistent with area mixed-use zoning. The cleanup action is consistent with updates to the federal navigation channel that are being performed in accordance with Port Resolution 1230. Final effective water depths (the water depths available for use by vessels at the face of docks and navigation improvements) in the Inner Whatcom Waterway navigation areas will range from 18 to 22 feet. Under the updated channel dimensions, these effective water depths can be maintained without requiring the use of bulkheads, over-water

wharves and hardened shorelines common to deep draft navigation channels.

- **Cleanup of Other Site Areas:** Capping, monitored natural recovery and institutional controls will be applied to outlying areas of the site with low-level subsurface sediment impacts, and where those actions are consistent with planned land and navigation use. Capping in the ASB shoulder area (Unit 5-B) will result in enhancement of nearshore aquatic habitat in this area if implemented using the design concept from Appendix C.

- **Sediment Disposal:** Sediments and sludges removed from the site during the cleanup will be managed by upland disposal at off-site, permitted Subtitle D facilities, rather than by creating a new sediment disposal site on Bellingham Bay.

9.2 Basis for Alternative Identification

The preferred remedial alternatives were identified consistent with MTCA and SMS alternatives evaluation and remedy selection criteria. These criteria include the following:

- **Compliance with MTCA Threshold Criteria**: Both alternatives 5 and 6 comply with MTCA threshold criteria. The compliance of these alternatives with MTCA Threshold criteria is discussed in Section 7.2.

- **Use of a reasonable restoration time-frame:** Of the evaluated alternatives, Alternatives 5 and 6 have relatively short restoration time-frames of 5 to 6 years, including the time required for design, permitting and construction. The restoration time-frames for each of the evaluated alternatives are discussed in Section 7.2.

- **Use of Permanent Solutions to the Maximum Extent Practicable:** As described in Section 7.3, Alternatives 5 and 6 use permanent solutions to the maximum extent practicable, based on the findings of the MTCA disproportionate cost analysis. Alternatives 5 and 6 are both costly, with probable costs of $42 million and $44 million, respectively. However, significant environmental benefits are achieved through the investments required under these alternatives, and the costs are not disproportionate to these benefits. Other lower-cost alternatives provide a lower degree of environmental benefit than Alternatives 5 and 6. Higher-cost alternatives were determined to be impracticable, because their incremental costs were substantial and disproportionate to the incremental benefits of those alternatives.

In addition to the alternatives analysis conducted in this Feasibility Study, project alternatives were evaluated in the companion EIS document as described in Section 8. The EIS analysis included an evaluation of environmental impacts and potentially required mitigation measures consistent with SEPA regulations. The two preferred remedial alternatives were found to provide net beneficial impacts, and to include appropriate mitigation measures. Neither of the preferred alternatives resulted in adverse impacts that were not mitigated.

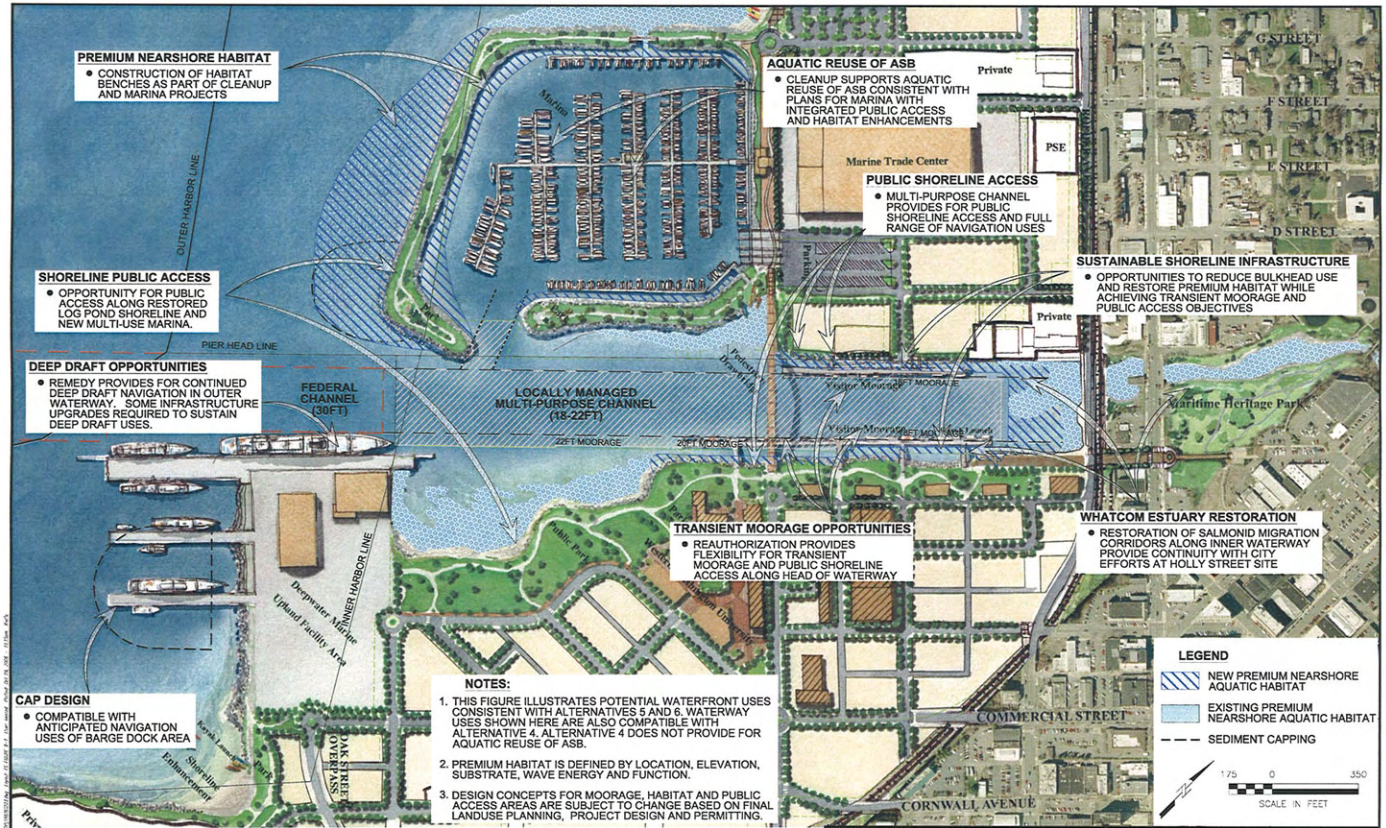
The companion EIS document also included an evaluation of the project alternatives against the goals of the Bellingham Bay Demonstration Pilot. Both Alternatives 5 and 6 were found to further each of the Pilot goals, and these alternatives were ranked highest of the eight evaluated alternatives. The high Pilot rankings indicate that Alternatives 5 and 6 have a high degree of consistency with the Bellingham Bay Comprehensive Strategy.

9.3 Implementation of Site Cleanup

This RI/FS, the companion EIS document, and public comment on both documents will inform Ecology's preliminary selection of a cleanup alternative for the Whatcom Waterway site. The preliminary selected alternative will be articulated for public review in a draft Cleanup Action Plan (CAP). Following public review of the CAP, the cleanup will move forward into design, permitting, construction and long-term monitoring.

The Port has stated that it has the financial resources necessary to implement Alternative 5 or Alternative 6 in a timely manner. During completion of the 2004 and 2005 due diligence evaluations prior to purchase of the GP waterfront properties, the Port developed a funding plan for implementation of "Alternative K", on which the preferred remedial alternatives are based. That funding plan includes anticipated grant funding from Ecology's Solid Waste and Financial Assistance Program and funds from moorage revenues generated by planned aquatic reuse of the ASB.

The Port also believes that implementation of the preferred alternatives can be conducted in a manner that is consistent with and that directly supports waterfront revitalization efforts. Figure 9-1 illustrates conceptually how the preferred remedial alternatives can be integrated with ongoing waterfront revitalization efforts, as identified in the September 2006 New Whatcom Draft Framework Plan. Final details of the remedial alternatives and how they are integrated with land use planning will be subject to Ecology's cleanup decisions, project design and permitting, and the results of on-going land use planning efforts.



RETEC

WHATCOM WATERWAY SUPPLEMENTAL EIS

DATE: 10/6/06 | DRWN: E.M./SEA

POTENTIAL INTEGRATION OF WATERFRONT USES WITH WITH FS ALTERNATIVES 5 AND 6

FIGURE 9-1

10 References Cited

Anchor Environmental (Anchor) and Hart Crowser, 2000. Remedial Investigation and Feasibility Study for the Whatcom Waterway Site. Prepared for Georgia Pacific Corporation.

Anchor Environmental (Anchor), 2002. Supplemental Feasibility Study for the Whatcom Waterway Site. Prepared for Georgia Pacific Corporation.

Anchor Environmental (Anchor), 2003b. *Literature Review of Effects of Resuspended Sediments Due to Dredging Operations*. Prepared for the Los Angeles Contaminated Sediments Task Force, Los Angeles, California. Prepared by Anchor Environmental CA LP, Seattle, Washington. June.

Anchor Environmental (Anchor) and Landau Associates, 2003a. Pre-Remedial Design Evaluation Data Report for the Whatcom Waterway Site. Prepared for Georgia Pacific Corporation, the City of Bellingham, Port of Bellingham and the Department of Natural Resources.

Apitz, S. E., J. W. Davis, K. Finkelstein, D. L. Hohreiter, R. Hoke, R. H. Jensen, J. M. Jersak, V. J. Kirtay, E. E. Mack, V. Magar, D. Moore, D. Reible and R. Stahl, 2002. *Critical Issues for Contaminated Sediment Management*, MESO-02-TM-01, March 2002. Marine Environmental Support Office, United States Navy.
http://meso.spawar.navy.mil/docs/MESO-02-TM-01.pdf

Averett, D., 1997. "Data Requirements for Advancing Techniques to Predict Dredge-Induced Sediment and Contaminant Releases—A Review." In: *Dredging, Remediation, and Containment of Contaminated Sediments*. ASTM STP 1293, K. R. Demars, G. N. Richardson, R. N. Yong, and R. C. Chancey (ed.). American Society of Testing and Materials, Philadelphia. p. 128–135.

Averett D., M. R. Palermo and R. Wade, 1988. *Verification of Procedures for Designing Dredged Material Containment Areas for Solids Retention.* Miscellaneous Paper D-88-2. United States Army Corps of Engineers, Dredging Operations Technical Support Program. United States Army Corps of Engineers Waterways Experiment Station, Vicksburgh, Mississippi.

Averett, D., E. Daniel, B. D. Perry, and E. J. Torrey, 1990. *Review of Removal, Containment and Treatment Technologies for Remediation of Contaminated Sediment in the Great Lakes*. United States Army Corps of Engineers, Miscellaneous papers, EL-90-25.

Averett, D., D. F. Hayes, and P. R. Schroeder, 1999. *Estimated Contaminant Losses During Dredging*. World Dredging Association, 19th Technical Conference.

Brannon et al., 1990. *Comprehensive Analysis of Migration Pathways (CAMP): Contaminant Migration Pathways at Confined Dredged Material Disposal Facilities.*

Cleland, J., 2000. *Results of Contaminated Sediment Cleanups Relevant to the Hudson River: An Update to Scenic Hudson's Report "Advances in Dredging Contaminated Sediment."* Prepared for Scenic Hudson, Poughkeepsie, New York. October.

Cunningham, K., T. Thompson, C. Houck, P.E., L. Mortensen, and K. Smayda, 2001. "Environmental Monitoring During Construction of a Subaqueous Sand Cap," from the Proceedings of Wetlands & Remediation - An International Conference, September 5-6, 2001.

Department of Natural Resources (DNR), 2005. Memorandum of Understanding by and Between the Port of Bellingham and the Department of Natural Resources. DNR MOU #06-129. Signed by the Washington Department of Natural Resources and the Port of Bellingham.

DOF, 2004. Remedial Action Construction Report, Head of Thea Foss Waterway. Tacoma, WA. Report prepared by Dalton, Olmsted and Fuglevand, Inc. Kirkland, WA.

Davis, J., T. Dekker, M. Erickson, V. Magar, C. Patmont, and M. Swindoll. 2004. Framework For Evaluating The Effectiveness Of Monitored Natural Recovery (MNR) As A Contaminated Sediment Management Option Working Draft, June 2004. Remediation Technologies Development Forum (RTDF) Sediment Subgroup. Working Draft available at http://www.rtdf.org/public/sediment/mnrpapers.htm

Demars, K. R., G. N. Richardson, R. Yong, and R. Chaney, 1995. *Dredging, Remediation and Containment of Contaminated Sediments*. American Society for Testing and Materials Publication STP 1293.

Ecology, 1991. *Sediment Cleanup Users Manual.* Sediment Management Unit, Washington Department of Ecology. Olympia, Washington. December 1991.

Hart Crowser and Pentec Environmental, 2002. *Final (100 Percent) Design Documents Olympic View Resource Area Non-Time-Critical Removal Action, Tacoma, Washington.* Prepared for the City of Tacoma. January.

Havis, R. N., 1988. *Sediment Resuspension by Selected Dredges, Effects on Dredging*. Technical Notes EEDP-09-02. United States Army Corps of Engineers Waterways Experiment Station, Vicksburg, Mississippi.

Herbich, J., 1997. "Removal of Contaminated Sediments: Equipment and Recent Field Studies. In: *Dredging, Remediation, and Containment of Contaminated Sediments*. ASTM STP 1293.

Herbich, 2000. *Handbook of Dredging Engineering*. Second Edition. New York, McGraw Hill.

Makers. 2004. Bellingham Bay Potential Marina Site Survey. Prepared for the Port of Bellingham.

McLaughlin, D. F., S. V. Dighe, D. L. Keairns and N. H. Ulerich, 1999. *Decontamination and Beneficial Reuse of Dredged Estuarine Sediment: The Westinghouse Plasma Vitrification Process*. May. p. 6-22.

McLellan and Hopman, 2000. *Innovations in Dredging Technology: Equipment, Operations, and Management*. ERDC-TR-DOER-5. Prepared for the United States Army Corps of Engineers, DOER Program. April 5.

National Research Council (NRC), 1997. *Contaminated Sediments in Ports and Waterways: Cleanup Strategies and Technologies*. National Research Council, Committee on Contaminated Marine Sediments. National Academy Press, Washington, D.C.

National Research Council (NRC), 2001. *A Risk-Management Strategy for PCB-contaminated Sediments*. Committee on Remediation of PCB-contaminated sediments. National Research Council. Prepared for the National Academy of Sciences and the United States Environmental Protection Agency. National Academy Press, Washington, DC.

Office of Solid Waste and Emergency Response (OSWER), 2004. *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites*. Draft. February.

Palermo, M. 2002. "A State of the Art Overview of Contaminated Sediment Remediation in the United States." In (A. Porta and R.E. Hinchee, eds) *Proceedings of the First International Conference on Remediation of Contaminated Sediments, 10-12 October 2001, Venice, Italy*. Battelle Press. Website: http://www.battelle.org/bclscrpt/bookstore/booktemplate.cfm?ISBN=1%2D57477%2D125%2D6.

Palermo, M. R., J. E. Clausner, M. P. Rollings, G. L. Williams, T. E. Myers, T. J. Fredette and R. E. Randall, 1998a. *Guidance for Subaqueous Dredged Material Capping*. Technical Report DOER-1. United States Army Corps of Engineers, Waterways Experiment Station, Vicksburg, Mississippi. Website: http://www.wes.army.mil/el/dots/doer/pdf/doer-1.pdf.

Palermo, M. R., J. Miller, S. Maynord and D. Reible, 1998b. *Assessment and Remediation of Contaminated Sediments (ARCS) Program Guidance for In-Situ Subaqueous Capping of Contaminated Sediments*. EPA 905/B-96/004. Prepared for the Great Lakes National Program Office, United States

Environmental Protection Agency, Chicago, Illinois. Website: http://www.epa.gov/glnpo/sediment/iscmain.

Sumeri, A., 1984. "Capped In-Water Disposal of Contaminated Dredged Material," in "Dredging and Dredged Material Disposal" (Vol 2), R. L. Montgomery and J. W. Leach, eds., *Proceedings of Conference Dredging '84*, American Society of Civil Engineers, Clearwater Beach, FL.

Sumeri, A. 1989. "Confined Aquatic Disposal and Capping of Contaminated Sediments in Puget Sound," *Proceedings of WODCON XII*; Dredging: Technology, Environmental, Mining, World Dredging Congress, Orlando, FL.

Thompson, T., G. Hartman, C. Houck, J. Lally, and R. Paulson, 2003. Methods And Considerations For Cap Design, Contracting, Construction, And Monitoring Over Soft, Unconsolidated Sediments. Proceedings of the In-Situ Contaminated Sediment Capping Workshop. May, 2003.

U.S. Army Corps of Engineers (USACE), 1987. *Engineering and Design – Confined Disposal of Dredged Material*. Engineer Manual No. 1110-2-5027. United States Army Corps of Engineers, Washington, D.C.

U.S. Army Corps of Engineers (USACE), 1994. *Sediment Chemistry Profiles of Capped Deposits Taken 3 to 11 Years After Capping*. Dredging Research Technical Notes. DRP-549. May.

U.S. Army Corps of Engineers (USACE), 1995. Geotechnical Descriptors for Dredgeability. Waterways Experiment Station, Dredging Research Technical Notes. DRP-2-13. January 1995. Available on the web at http://el.erdc.usace.army.mil/elpubs/pdf/drp2-13.pdf .

U.S. Army Corps of Engineers (USACE), 2000. *Innovative Dredged Sediment Decontamination and Treatment Technologies*. U.S. Army Corps of Engineers, ERDC TN-DOER-T2. December, 2000

U.S. Army Corps of Engineers (USACE), 2003. *Puget Sound Confined Disposal Site Study, Washington*. United States Army Corps of Engineers.

U.S. Army Corps of Engineers (USACE), Washington State Department of Ecology, and Washington State Department of Natural Resources, 1999. *Puget Sound Confined Disposal Site Study Programmatic NEPA/SEPA Environmental Impact Statement*. Prepared in cooperation with Striplin Environmental Associates, Anchor Environmental, Ogden Beeman Associates, ECO Resource Group, EnviroIssues, and Marshal and Associates. Two volumes. October.

U.S. Environmental Protection Agency (EPA), 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*. EPA/540/G-89/004. United States Environmental Protection Agency.

U.S. Environmental Protection Agency (EPA), 1989. Superfund Record of Decision: Commencement Bay, Near Shore/Tide Flats. Pierce County, WA. EPA/ROD/R10-89/020.

U.S. Environmental Protection Agency (EPA), 1994a. *Assessment and Remediation of Contaminated Sediments (ARCS) Program, Final Summary Report*. EPA 905-S-94-001. United States Environmental Protection Agency.

U.S. Environmental Protection Agency (EPA), 1994b. *Assessment and Remediation of Contaminated Sediments (ARCS) Program. Remediation Guidance Document*. United States Environmental Protection Agency, Great Lakes National Program Office. EPA 905-R94-003. October.

U.S. Environmental Protection Agency (EPA), 1996. *Design, Performance, and Monitoring of Dredged Material Confined Disposal Facilities in Region 5*. Contract Document 68-CO-0068-43. United States Environmental Protection Agency, Region 5, Chicago, Illinois.

U.S. Environmental Protection Agency (EPA), 1999. *A Guide for Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents*. EPA/540/R-98/031, OSWER Directive 92001.1-23P, July 1999.

U.S. Environmental Protection Agency (EPA), 2000. Equilibrium partitioning sediment guidelines (ESGs) for the protection of benthic organisms: Metal mixtures (cadmium, copper, lead, nickel, silver and zinc). EPA 822-R-00-005. Office of Science and Technology, Office of Research and Development. Washington, DC.

U.S. Environmental Protection Agency (EPA), 2002. *Principles for Managing Contaminated Sediment Risks at Hazardous Waste Sites*. United States Environmental Protection Agency.

U.S. Environmental Protection Agency (EPA), 2004. *Hudson River PCBs Superfund Site. Engineering Performance Standards*. Volumes 1–5. United States Environmental Protection Agency Region 2. Prepared for the United States Army Corps of Engineers, Kansas City District by Malcom Pirinie and TAMS Consultants.

Wang, T. K. Larm, and D. Hotchkiss. 2003. *Evaluation of Closed Buckets for Remedial Dredging and Case Histories.* In (S. Garbaciak, ed.) Dredging 2002: Key Technologies for Global Prosperity 3rd Specialty Conference on Dredging and Dredged Material Disposal. May 5–8, 2002, Orlando, Florida, USA. American Society of Civil Engineers Publications, Reston, VA: ASCE/COPRI, 0-7844-0680-4, 2003.

Waterfront Futures Group (WFG), 2004. Waterfront Vision and Framework Plan: Waterfront Futures Group Final Recommendations. Sponsored by the City of Bellingham and Port of Bellingham.

Appendix A

Unit Cost and Volume Assumptions

Appendix B

Remedial Cost Estimates

Appendix C

Habitat Bench Design Issues for Areas Offshore of ASB

Appendix D

Proposed Enhancements to Shoreline Conditions within the Log Pond